Dissertation on

A STUDY ON THE CORRELATION BETWEEN BODY MASS INDEX AND PEAK EXPIRATORY FLOW RATE IN SCHOOL-GOING CHILDREN AGED BETWEEN 8 AND 15 YEARS IN CHENNAI, INDIA.

Submitted to

THE TAMIL NADU

DR. M.G.R. MEDICAL UNIVERSITY

in partial fulfilment of the requirement

for the award of degree of

M.D., BRANCH - VII

PAEDIATRIC MEDICINE

ESIC MEDICAL COLLEGE & PGIMSR

K.K. NAGAR, CHENNAI.

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI, TAMILNADU

APRIL 2017

CERTIFICATE

Certified that this dissertation titled **"A STUDY ON THE CORRELATION BETWEEN BODY MASS INDEX AND PEAK EXPIRATORY FLOW RATE IN SCHOOL-GOING CHILDREN AGED BETWEEN 8 AND 15 YEARS IN CHENNAI, INDIA",** is a bonafide work done by **Dr. ANDREA JOSEPHINE R,** Post-graduate, ESIC Medical College & PGIMSR, K.K. Nagar, Chennai, during the academic year 2013-2017.

Dr. Sowmya Sampath, MD, DNB
Professor & Head,
Department of Paediatrics
ESIC Medical College & PGIMSR
K.K. Nagar
Chennai

Dr. Kumar M, MD
Assistant Professor
Department of Paediatrics
ESIC Medical College & PGIMSR
K.K. Nagar
Chennai

Prof. Dr. Srikumari Damodaram, MS, MCh
Dean
ESIC Medical College & PGIMSR
K. K. Nagar, Chennai

DECLARATION

I solemnly declare that this dissertation titled **"A study on the correlation between Body Mass Index and Peak Expiratory Flow Rate in school-going children aged between 8 and 15 years in Chennai, India"** has been conducted by me at ESIC Medical College & PGIMSR, Chennai, under the guidance and supervision of **Dr. Sowmya Sampath, MD, DNB,** Professor & Head, Department of Paediatrics, ESIC Medical College & PGIMSR, Chennai. This dissertation is submitted to **The Tamil Nadu Dr. M.G.R. Medical University, Chennai** in partial fulfilment of the University regulations for the award of the degree of **M.D. Branch VII (Paediatrics)**.

Date:

Place: Chennai (Dr. Andrea Josephine R)

IRB APPROVAL

CERTIFICATE OF APPROVAL

To

Dr. Andrea Josephine R,
PG in Department of Paediatrics,
ESIC Medical College & PGIMSR,
KK Nagar, Chennai-78.

Dear Dr. Andrea Josephine R,

The Institutional Ethical Committee of ESIC Medical College & PGIMSR reviewed and discussed your application for approval of the proposal entitled **"A study on the correlation between Body Mass Index and Peak Expiratory Flow Rate in school-going children aged between 8-15 years in Chennai, India"** at ESIC Medical College & PGIMSR, K K Nagar, Chennai 600 078", No. **01- 03/07/2015.**.

The following members of the Ethical Committee were present.in the meeting held on 03.07.2015 conducted at ESIC Medical College & PGIMSR, KK Nagar, Chennai-78.

S.No.	ETHICAL COMMITTEE MEMBERS
1.	Prof. A.V. Srinivasan, Chairperson, EC Member
2.	Prof. V. Rajalakshmi, Member Secretary, Registrar, ESIC Medical College & PGIMSR, EC Member
3.	Prof. Sowmya Sampath, Prof. & HOD, Department of Paediatrics, ESIC Medical College & PGIMSR, EC Member
4.	Prof. S. Seethalakshmi, Prof. & HOD, Department of Pharmacology, ESIC Medical College & PGIMSR, EC Member
5.	Prof. S. Gayathri, Prof. & HOD, Department of Anaesthesiology ESIC Medical College & PGIMSR, EC Member
6.	Dr. Aruna Patil Bholenath, Assistant Professor, Department of Community Medicine, ESIC Medical College & PGIMSR, EC Member
7.	Dr. O.L. Naganath Babu, Dept. of Surgical Gastroenterology, EC Member
8.	Dr. S. Dhanalakshmi, Dept. of OBG, EC Member
9.	Dr. T.S. Swaminathan, Dept. of Radiology, EC Member
10.	Dr. N. Krishnan, Dept. of Anesthesia, EC Member
11.	Prof. C. Rajendiran, Department of General Medicine, EC Member
12.	Dr. Napinai, Clinical Psychologist, EC Member
13.	Dr. C.V. Aravindan, Scientist, EC Member
14.	Shri. K M Venugopal, Advocate, EC Member

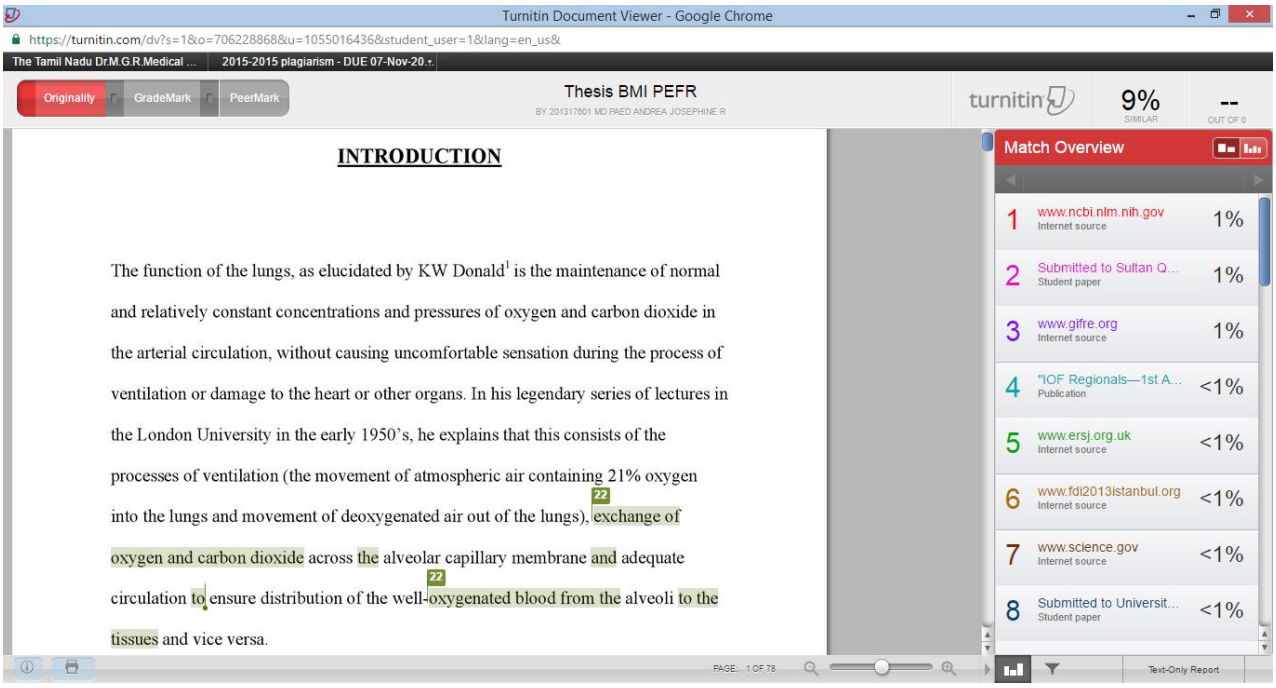
The proposal is approved to be conducted in its presented form.

The Institutional Ethical Committee expects to be informed about the progress of the study and significant adverse effects occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

[DR. A.V. SRINIVASAN]
CHAIRPERSON
ETHICAL COMMITTEE

Date : 03.07.2015
Place : Chennai 78

PLAGIARISM CERTIFICATE



ACKNOWLEDGEMENTS

Above all, I thank God for this opportunity and for sustaining me at every step of the way to the completion of this study and writing the dissertation.

I would like to thank our Dean, Dr. Srikumari Damodaram, for having provided us a fertile ground for research in our institution. She has been a constant source of inspiration and encouragement for us to excel in our academics.

I extend my heartfelt gratitude to Dr. Sowmya Sampath, my guide and mentor, who has guided me in this study right from its inception till its final completion. It is my privilege to be mentored by her in academics, research and life, and she has passed on her valuable experience in the field of research. Her meticulous editing has definitely reflected on the dissertation.

I profusely thank Dr. Henry Suresh David, our Senior Consultant, for his painstaking efforts in going out of the way in liaising with the Principals and Correspondents of the two schools to obtain permission to conduct this study, accompanying me and spending so much of his valuable time and effort in ensuring the speedy and effective completion of the study.

I extend my warm thanks to Dr. S. Shobhana, Associate Professor, for always cheerfully offering her support in helping me to select the topic and formulate the protocol for this study.

I am ever grateful to Dr. M. Kumar, my co-guide and Assistant Professor, who shared his valuable experience and aided me in narrowing down on the topic for this study and formulation of the study protocol.

I thank Dr. Vijayaprasad Gopichandran, Assistant Professor, Department of Community Medicine, for his able guidance and inputs on how to write the dissertation and efforts at teaching me how to do the statistical analysis on my own. I also thank Dr. Aruna Patil, Statistician, for helping me with the sample size calculation in this study. I cannot forget to mention my brother, Adrian, who gave his critical inputs, aided me in obtaining the final results of statistical analysis and helped me in the correct interpretation of my results.

I extend my heartfelt gratitude to the Principals and Correspondents of St John's Matriculation Higher Secondary School, Alwar Thiru Nagar, Chennai and Vailankanni Matriculation Higher Secondary School, KK Nagar, Chennai for granting me permission to conduct my study on their students. I also thank each of the teachers who so efficiently coordinated with me to help conduct my study.

I would like to acknowledge and thank each of our Consultants, Assistant Professors and Senior Residents who shared their experience and inputs to help and encourage me to complete my study: Dr. Sridharan, Dr. Aparna, Dr. Sathish Kumar, Dr. Shantha Kumari, Dr. Mohan Kumar, Dr. Prasantha Kumar and Dr. Sunitha.

I thank my seniors, Dr. Lenin, Dr. Nithiyanandham, Dr. Poornima, Dr. Brindha and Dr. Indhumathi and my fellow post-graduates Dr. Saranya and Dr. Ramakrishnan for their support and input, which helped me in the successful completion of my dissertation.

I personally thank each of the parents and children who participated in this study and shared with me their personal information and their efforts at performing a forceful expiratory maneuver. I also thank my husband, son, parents, family and friends for their unending support throughout the course of my study.

ABSTRACT

Objective: To study the correlation between Body Mass Index (BMI) and Peak expiratory flow rate (PEFR) in school-going children.

Background: In various studies, obesity has been observed to be associated with asthma and loss of weight associated with improvement in respiratory symptoms; thus, we undertook to study the influence of BMI on PEFR.

Methods: 510 healthy school-children aged between 8 and 15 years were recruited into the study, excluding those with past or present asthma, respiratory infection and systemic illness. Age, weight, height and PEFR were measured and a questionnaire filled. Statistical analysis was done to study the factors influencing PEFR using simple and multiple regression analysis.

Results: Age, gender, weight, height, BMI and exposure to mosquito repellent had a significant influence on PEFR by simple regression analysis ($p<0.05$). Correlation coefficients for age, weight, height and BMI with relation to PEFR were 0.52, 0.46, 0.59 and 0.17 respectively. Using multiple regression analysis, it was demonstrated that the effect of BMI on PEFR was not seen ($p>0.05$) when other factors including age, gender and exposure to mosquito repellent were controlled for. However, age, weight, height and exposure to mosquito repellent had a significant influence on PEFR, even after controlling for other variables ($p<0.05$). BMI, in its extremes, has no significant influence on PEFR.

Conclusion: BMI has a weak positive relationship with PEFR, but this is not seen when controlling for other factors. Age, weight and height have a positive influence, whereas exposure to mosquito repellent has a negative influence on PEFR. In its extremes, BMI has no significant influence on PEFR.

CONTENTS

CHAPTER	TITLE	PAGE NO.
1.	INTRODUCTION	1
2.	AIMS AND OBJECTIVES	8
3.	REVIEW OF LITERATURE	10
4.	STUDY JUSTIFICATION	20
5.	MATERIALS AND METHODS	22
6.	RESULTS	29
7.	DISCUSSION	54
8.	CONCLUSION	75
9.	LIMITATIONS	77
10.	RECOMMENDATIONS	80
11.	REFERENCES	
12.	ANNEXURES	

LIST OF ABBREVIATIONS USED

Body Mass Index	BMI
Body surface area	BSA
Diffusion capacity of lung for carbon monoxide	DLCO
Forced expiratory flow between 25-75% of vital capacity	$FEF_{25-75\%}$
Forced expiratory volume in first second	FEV1
Forced vital capacity	FVC
Functional residual capacity	FRC
Maximum mid-expiratory flow	MMEF
Mid-upper arm circumference	MAC
Peak expiratory flow rate	PEFR
Pulmonary function test	PFT
Residual volume	RV
Total lung capacity	TLC
Vital capacity	VC

INTRODUCTION

INTRODUCTION

The function of the lungs, as elucidated by KW Donald[1] is the maintenance of normal and relatively constant concentrations and pressures of oxygen and carbon dioxide in the arterial circulation, without causing uncomfortable sensation during the process of ventilation or damage to the heart or other organs. In his legendary series of lectures in the London University in the early 1950's, he explains that this consists of the processes of ventilation (the movement of atmospheric air containing 21% oxygen into the lungs and movement of deoxygenated air out of the lungs), exchange of oxygen and carbon dioxide across the alveolar capillary membrane and adequate circulation to ensure distribution of the well-oxygenated blood from the alveoli to the tissues and vice versa.

The American Thoracic Society and the European Respiratory Society (ATS/ERS) have issued joint statements to specify the general considerations while performing lung function testing[2]. The contra-indications to performing pulmonary function tests (PFTs) are a history of myocardial infarction within the previous month, unstable angina, recent thoracic, abdominal or ophthalmic surgery, intra-thoracic or abdominal aneurysm and pneumothorax[3]. PFTs should be performed in a sitting position in order to prevent falls in the event of syncope occurring during the procedure. Prior to performing PFTs, the patient should be asked to avoid smoking within an hour, alcohol consumption within

4 hours, undergoing strenuous exercise within half an hour, eating a heavy meal within 2 hours of testing and wearing constricting clothes that limit thoracic and abdominal expansion. Each test is performed thrice to ensure accuracy and reproducibility. Dynamic tests including spirometry, peak flows and flow-volume curves are performed in the beginning and then lung volumes are measured, followed by bronchodilator response tests and in the end, diffusion capacity is tested.

Spirometry[2-5] :

1. **Forced vital capacity (FVC) :** The patient is asked to take a maximal inspiration followed by a maximal forceful expiration for as quickly and as long as possible. The maximum volume of air thus exhaled is measured to give the forced vital capacity in litres.
2. **Forced expiratory volume in first second (FEV1)** : The volume of air that is exhaled during the first second of a maximal forceful expiratory maneuver is defined as FEV1 in litres.
3. **FEV1/FVC** : The ratio between FEV1 and FVC is called the Tiffeneau-Pinelli index[4]. When it is less than 70%, it denotes an obstructive lung pathology and when >70%, it signifies a restrictive lung disease.
4. **Peak expiratory flow rate (PEFR)** : The maximum rate at which air is exhaled during a forceful expiration after a maximal inspiration is called the PEFR, expressed in litres/minute. It is decreased in obstructive lung

disease. It depends on the limitation of air flow in central and peripheral airways.

5. **Maximum mid-expiratory flow (MMEF) and Forced expiratory flow between 25-75% of vital capacity ($FEF_{25-75\%}$)** : MMEF is defined as the average expiratory flow measured in the middle of the FVC. $FEF_{25-75\%}$ is defined as the maximum expiratory flow measured between 25-75% of forced vital capacity. It measures the resistance of smaller airways but is highly effort-dependent and depends on accurate measurement of the FVC.
6. **Flow-volume curves** : These are graphs produced by asking the patient to perform a maximal inspiratory effort followed by a maximal exhalation, consisting of a positive expiratory limb and a negative inspiratory limb. In obstructive airway diseases, the expiratory limb demonstrates a concavity with scalloping, while in restrictive lung disease, the expiratory limb shows a convexity.
7. **Bronchodilator testing** : An increase in FEV1 of 12% or more and 200mL or more in response to an inhaled bronchodilator like salbutamol is suggestive of asthma.
8. **Lung volumes** :
    i. **Residual volume (RV)** : The volume of air remaining in the lungs even after maximal expiration is usually around 500mL. This is increased in obstructive lung disease with air-trapping and incomplete emptying during expiration.

ii. **Total lung capacity (TLC) :** The amount of air contained in the lungs after a maximal inspiration, which consists of vital capacity in addition to residual volume. This is increased in obstructive lung disease and decreased in restrictive lung disease.

iii. **Functional residual capacity (FRC) :** This is the volume of air contained in the lungs after normal expiration. It is increased in obstructive lung disease and decreased in restrictive lung disease.

iv. **Vital capacity (VC) :** This is the volume of air that is inhaled during a maximal inspiration after a maximal expiration. It is decreased in restrictive lung disease.

9. **Diffusing capacity of the lung for Carbon monoxide (DLCO)** : This gives information about the alveolocapillary membrane surface area and integrity as measured by the diffusing capacity for carbon monoxide, which in turn reflects that for oxygen. In children, it is more common with rheumatological disorders and patients with malignancy exposed to radiation and cytotoxic agents.
10. **Arterial blood gas analysis** : This gives an idea about gaseous exchange and oxygen delivery at the tissue level.

Peak expiratory flow rate[6] :

This parameter is often used in clinical practice to monitor response to therapy in asthmatic patients and for self-monitoring of disease process at home[7]. This is because spirometers are not readily available and accessible and

simple handheld instruments are now available to measure the peak expiratory flow[8]. Though FEV1 has been described as the gold standard to assess airway resistance, it has been found that there is good correlation between FEV1 and PEFR measurements[9,10].

Peak expiratory flow rate depends on the lung volumes, strength of the respiratory muscles, airway resistance in the large airways and the recoil of the bony thorax and diaphragm[9,10]. It is more effort-dependant than FEV1, but easier to perform and measure in children[11].

Factors affecting peak expiratory flow rate[9,12-15] :

There are various factors that have an influence on the peak expiratory flow rate of an individual. These include:

i) Age

ii) Gender

iii) Anthropometric parameters:

Height, weight, sitting height, chest circumference, body mass index, body surface area, fat-free mass, hip circumference, waist circumference, waist-hip ratio, waist-thigh ratio, waist-height ratio, subscapular and triceps skin fold thickness

iv) Environmental factors: Air pollution, smoking, physical exercise, posture

v) Genetic factors: Ethnicity, family history of asthma

vi) Pathological processes: Past or present history of asthma, bronchitis, emphysema, chronic obstructive pulmonary disease, bronchiectasis, respiratory infections, musculoskeletal disorders like kyphoscoliosis, neuromuscular disorders, cardiac failure and cardiomyopathy

vii) Time of measurement: There is physiological diurnal variation in PEFR with a dip during the night and on waking in the morning. There is also a day-to-day variability seen in PEFR.

viii) Use of bronchodilator increases the PEFR

ix) Instrument used to measure the PEFR

We undertook this study to study the correlation between BMI and PEFR in our study population.

AIMS AND OBJECTIVES

AIMS AND OBJECTIVES

Aim

To study the correlation between body mass index (BMI) and peak expiratory flow rate (PEFR) in school-going children.

Objectives

Primary objective

To study the correlation between BMI and PEFR in school-going children.

Secondary objectives

- To study the correlation between PEFR and demographic and other anthropometric parameters such as age, weight, height and gender and familial and environmental factors including family history of asthma, pets, exposure to indoor smoking and mosquito repellent in school-going children

REVIEW OF LITERATURE

REVIEW OF LITERATURE

I. Studies on the correlation between Body mass index and peak expiratory flow rate in healthy children:

In a study conducted by Pistelli et al[16] in 2,176 children aged between 7-11 years in Central Italy in 1987, spirometric data including forced vital capacity (FVC), forced expiratory volume in one second (FEV1), peak expiratory flow (PEF), maximal expiratory flow at 50 and 25% of FVC above residual volume (MEF50 & MEF25) and the mean forced expiratory flow during the middle half of the FVC (FEF25-75) were studied in relation to sex, age, anthropometric variables including weight, height and body mass index. Three best forced expiratory maneuvers were chosen out of a maximum of eight trials and measured by water-sealed light bell spirometers. Since the relationship between spirometric data and age, height and BMI was found to be non-linear, the variables were transformed logarithmically to linearize the relationship between them. Thereafter, regression equations were calculated for the logarithmic transformation of the spirometric data as the dependent variables and sex, $\log_e$ (height), $\log_e$ (BMI) and $\log_e$ (age) as the independent variables. The multiple regression models thus made, were found to have a better fit for FVC, FEV1 and PEF (r^2=0.655, 0.603 and 0.312 respectively) than for maximal expiratory flows.

Another unique feature of this study was that the presence of respiratory illness including recent respiratory infections, asthma, cough and phlegm and allergic rhinitis were forced in the models. On doing so, the presence of asthma, cough and phlegm resulted in a decrease in FEV and expiratory flows. History of a recent respiratory infection was associated with a decrease in expiratory flows. In particular, in overweight subjects (BMI >90^{th} centile), the relationship between height and lung volume was found to be different in each sex (coefficient for $\log_e$ (height) being higher in girls and lower in boys). The individual correlation coefficient between logarithm of Peak expiratory flow and logarithm of Body mass index was deduced as 0.109.

In a study on 1,078 healthy school-going children in a rural district in Wardha, India, by Taksande et al[17], PEFR was measured using the best of three forced expiratory efforts in a standing position and studied in relation to age, weight, height, mid-upper arm circumference (MAC), BMI and body surface area (BSA) in each sex separately. Children with acute or chronic respiratory conditions or major systemic illnesses were excluded from the study. The PEFR values were found to increase in a linear fashion with age, weight, height, MAC, BMI and BSA. The correlation coefficients for age, weight, height, MAC, BMI and BSA were significant ($p < 0.001$).

It was found that PEFR had the highest correlation to height in both sexes ($r = 0.62$ and 0.42 in males and females respectively). This was followed

by weight (r= 0.51 and 0.45), Body surface area (r=0.51 and 0.43), Body mass index (r=0.19 and 0.24) and Mid-arm circumference (r=0.29 and 0.15 in males and females respectively). Multiple linear regression analysis was not carried out in this study.

A study was conducted by Manjareeka et al[18] on 868 healthy school-going tribal children aged between 8 and 11 years in Odisha, India between September 2011 to March 2012. This study was done to study the effect of sex on the correlation between PEFR and anthropometric parameters in age-matched healthy tribal children. Children with acute or chronic respiratory conditions or major systemic illnesses were excluded from the study. PEFR was measured using a digital mini Wright peak flow meter as the best of three expiratory efforts in a sitting position in the evening between 4 and 5 p.m. It revealed a statistically significant ($p<0.05$) positive correlation between Peak expiratory flow rate and height (r= 0.57), BMI (r=0.30) and Chest circumference (r=0.48) in both sexes in the population studied. Here, there was a better correlation between the PEFR and the weight, height and chest circumference in boys when compared to girls. The anthropometric variables and PEFR were found to be significantly different between the different tribes using the post-hoc Least significant difference (LSD) test. Multiple linear regression analysis was not carried out in this study.

A study on the effects of being overweight on lung function was conducted by KP Fung et al[19] on 1586 healthy Chinese school-children aged between 6.5 and 20 years. Being overweight was defined as having a weight-for-height greater than or equal to the 90th percentile. The lung function tests studied were forced vital capacity, vital capacity, forced expiratory volume in one second and peak expiratory flow rate, using a spirometer in the standing position. The relationship of the lung functions with age, height, weight and body mass index was an exponential one, hence each of these were transformed logarithmically for the purpose of statistical analysis. Bivariate regression analysis was done using lung function tests as the dependent variables and height and body mass index as independent variables, and it was found that height predicted lung functions better than body mass index as measured by the standardized regression coefficients. In normal and overweight girls and normal boys, it was seen that the standardised regression coefficients of log body mass index ranged from 0.05 to 0.42 ($p<0.05$) for all tests except forced mid-expiratory flow rate, but $p>0.27$ in overweight boys for all lung function tests. When the confounding effects of height and age were removed, there were positive partial correlations between body mass index and lung function tests (standardized regression coefficients ranging from 0.05 to 0.42, $p<0.05$), except forced mid-expiratory flow rate, in both normal weight and overweight girls and in boys whose weight was normal, not in overweight boys.

In a study by D Choudhuri et al[20] on 640 healthy school-children aged between 10 and 14 years from Tripura, it was found that there was a low positive correlation between BMI and FVC (r=0.198), PEFR (r=0.133) and Maximum Voluntary Ventilation (MVV) (r=0.179) whereas FEV1/FVC% (r= -0.156) had a negative correlation with the BMI in the male children under study. On the other hand, when the data of the female children was analysed it was found that the BMI had a low positive correlation with PEFR (r=0.14) and low negative correlations with FEV1 (r= -0.189), FEV1/FVC% (r= -0.138) and $FEF_{25-75\%}$ (r= -0.159).

Multiple regression analyses was done in this study using FVC, FEV1, FEV1/FVC%, PEFR, FEF25-75% and MVV as the dependent variables and the independent variables being markers of obesity like weight, BMI, waist-height ratio, and waist-hip ratio for boys and girls separately. In these models with PEFR as dependent variable, the regression coefficient for BMI in boys is 0.08 and in girls, it is 0.011. But, since BMI is derived from weight, these two variables being included in the same regression model gives results of dubious reliability, though the p value is <0.05. The study was done using an expirograph in the standing position with nose clip held in position.

Ong et al[21] conducted a study on 391 healthy school children aged between 3 and 17 years to study the effect of nutritional indices including weight, body mass index, mid-upper arm circumference and subscapular and

triceps skinfold thicknesses on lung functions, i.e. FVC, FEV1 and PEFR. Both nutritional indices and lung functions were logarithmically transformed to stabilize variance and both in turn adjusted for sitting height to correct for isotropic growth, as sitting height correlates better with lung growth than stature.

Linear regression analyses showed that $\log_e (\text{weight})_c$, $\log_e (\text{BMI})_c$ and $\log_e (\text{MUAC})_c$ were correlated with $\log_e (\text{FVC})_c$, $\log_e (\text{FEV1})_c$ and $\log_e (\text{PEFR})_c$, whereas there was no significant correlation between the subscapular and triceps skin fold thicknesses and the above mentioned lung functions. In this, the regression coefficient between BMI and PEFR in boys was 0.17, while the p value was >0.05 in girls. Further, multiple regression analysis was done using $\log_e (\text{sitting height})_c$ and $\log_e (\text{weight})_c$ as the independent variables and $\log_e (\text{FVC})_c$, $\log_e (\text{FEV1})_c$ and $\log_e (\text{PEFR})_c$ as the dependent variables. Interestingly, this resulted in p value <0.001 when compared to the linear regression analysis and regression equations were thus derived for the above using sitting height and weight.

A study on 196 healthy subjects in Nepal aged between 5 to 25 years, conducted by Dhungel et al[22], concluded that age, weight, height, body mass index and body surface area showed a statistically significant positive correlation with peak expiratory flow rate ($p<0.05$), with correlation coefficients for BMI with PEFR being 0.69 in boys and 0.56 in girls. On the

other hand, waist-hip ratio and waist-thigh ratio, which are markers of central obesity showed significant negative correlation with the Peak expiratory flow rate in the subjects studied. Partial correlation coefficients for PEFR with the above physical characteristics were also calculated. The partial correlation coefficient for BMI with PEFR when age is controlled for, was 0.45 in boys and 0.32 in girls ($p<0.01$).

In a study conducted on 518 pre-school children aged 5.4 to 7 years in Germany by Kalhoff et al[23], it was concluded that there was no significant correlation ($p>0.05$) between Body mass index and the forced expiratory flow parameters, that included FVC, FEV1, PEFR and MEF_{50}. It was found that FEV1 and FVC correspond to reference values, but PEF and MEF_{50} reached only 68.9±13.6 and 75.9±26.6% of the reference values respectively. Thus, it was deduced that the reference values overestimate the expiratory parameters when the child performs an expiratory effort with time of expiration more than 1 second.

A total of 1105 healthy Libyan adolescents aged between 12 and 21 years were studied[24] to analyse the PEFR and the correlation between PEFR and various anthropometric parameters. The variables were transformed logarithmically for statistical analysis. It was found that there was a significant direct correlation between PEFR and age, sitting and standing height, BMI and body surface area ($p<0.05$). Regression equations were constructed between

PEFR and stature. It was found that the BMI-PEFR and age-PEFR regression slopes are considerably different between boys and girls.

A study done on 708 healthy school-children aged between 5 and 14 years from Berhampur[25], Odisha, India, studied the baseline PEFR and its correlation to anthropometric parameters. Significant positive correlations with PEFR were derived for height (r=0.819), weight (r=0.816), age (r=0.811) and BMI (r=0.431). Though the PEFR differed significantly between males and females, when adjusted for height, there was no significant difference between the two sexes.

II. **Studies on the correlation between Body mass index and Peak expiratory flow rate in obese subjects**:

In a cross-sectional controlled study by Ülger et al[26] on 38 obese children and 30 non-obese healthy children aged 9 to 15 years in Turkey, the differences in lung function tests including FEV1, FVC and PEF and measures of airway hyperresponsiveness like exercise provocation test, 4.5% hypertonic saline provocation test and terbutaline reversibility test were studied between the obese and non-obese groups.

It was found that the basal FVC, FEV1, PEF and forced expiratory flow between 25% and 75% of vital capacity (FEF25-75%) were all significantly lower in the obese group when compared to the non-obese group ($p<0.001$).

Also, statistically significant negative correlations were deduced between BMI, relative weight, log of subscapular and triceps skin fold thicknesses and waist-hip ratio and basal FVC, FEV1 and PEF values ($p<0.001$). The correlation coefficient for BMI and PEF was -0.69. It was also found that the proportion of positive exercise test and positive hypertonic saline provocation test among obese subjects was significantly more than in non-obese subjects ($p<0.05$).

STUDY JUSTIFICATION

STUDY JUSTIFICATION

Since there are varying contradictory reports about the correlation between BMI and PEFR and there are plausible explanations both for positive as well as negative influence of BMI on PEFR, this study was undertaken to study the effect of BMI on PEFR in our local population. If it is proved that increasing BMI is associated with a decrease in PEFR, weight reduction can be enforced for better control of asthma and obese children can be advised to undertake diet and exercise to avoid respiratory complications. Since BMI is a relatively age-independent measure, it can be used to predict PEFR reasonably across age groups if there is a linear relationship demonstrated between the two variables.

MATERIALS AND METHODS

MATERIALS AND METHODS

Methodology

Study design

Cross-sectional observational study

Place of study

Two private urban higher secondary schools in Chennai

Period of study

June 2015 to April 2016

Sample size

510 (285 boys and 225 girls)

Table 1. Calculation of sample size:

	Boys	**Girls**
Correlation coefficient between BMI and PEFR	0.19	0.24
Power (1- ß)%	80	80
□ error (%)	5	5
1 or 2 sided	2	2
Required sample size	210	128

Study population:

Students of two private urban higher secondary schools in Chennai

Inclusion criteria:

School children aged between 8 and 15 years

Exclusion criteria:

- History of any febrile illness in the preceding 1 week
- History of symptoms of upper or lower respiratory tract infection in the preceding 1 week
- Chronic respiratory disease e.g. bronchial asthma
- Systemic disease like cardiac or renal disorders
- Obvious deformity of thorax or spine
- Neuromuscular disorders

Methods

After obtaining ethical clearance from the Institutional Review Board, the study was undertaken at two different private higher secondary schools in west Chennai. Healthy school children between 8 and 15 years of age fulfilling the inclusion criteria were recruited into the study after obtaining informed written consent from the head of the institution.

The students were recruited into the study following oral interview using a pre-determined proforma. A thorough clinical examination was done to exclude acute or chronic respiratory illness, cardiac, renal, musculoskeletal and neuromuscular disorders.

Standing height was measured (without shoes) in centimetres with a standard portable stadiometer (Ishnee, India). The child was made to stand erect with the feet close together and the heels, buttocks and back of head touching the stadiometer. The head is positioned in the Frankfurt plane, with the lower margin of the orbit in line with the external auditory meatus. The weight was measured in kilograms, without shoes and with light clothing, by making the child stand still for one minute on a calibrated digital weighing scale (HealthSense PS 126 Ultra-Lite Personal Scale, India).

Figure 1. Weighing scale used in the study

Figure 2. Portable stadiometer used in the study

Body mass index (BMI) was calculated using the formula: Weight in kilograms/ (height in metres)^2.

Figure 3. Mini Wright's peak flow meter used in the study

Peak expiratory flow rate was measured using the Mini Wright's Peak Flow Meter (Ishnee, India). All included children were tested in an upright sitting position. Before testing, the child was allowed to rest for a period of five minutes. The procedure was explained and demonstrated to each child until full familiarity was achieved. Each child was asked to form a good seal around the mouth-piece of the peak flow meter, take a deep breath and then blow into the peak flow meter as hard and fast as he/ she could. Three trials were given and the best of three was chosen for analysis.

Statistical analysis

Data was entered into Microsoft Excel spreadsheet (Windows 8.1) and then statistical analysis done using SPSS software v.21.0 and R software v.3.3.1. First, the correlation between the various parameters including age, weight, height, BMI and PEFR was studied. Then, using simple linear regression, PEFR was taken as the dependent variable and age, gender, weight, height, BMI, parental history of asthma, presence of pets, exposure to indoor smoking and mosquito repellent were taken as the independent variables and the respective regression coefficients were calculated.

Collinearity between the independent variables was calculated by constructing a correlation matrix between them. The variables with a correlation coefficient of more than 0.6 were taken to be significantly correlated with each other and those with a correlation coefficient of less than

0.6 were not significantly correlated with each other. Multiple regression models were then constructed using a combination of the independent variables such that the latter were not significantly collinear with each other and the respective Pearson correlation coefficients calculated. A p value of <0.05 was taken as statistically significant.

Outcome measure

- Correlation between BMI and PEFR
- Correlation between age, sex, weight, height, family history of asthma, presence of pets, exposure to indoor smoking and mosquito repellent and peak expiratory flow rate

RESULTS

RESULTS

A total of 670 children were screened; 108 children were excluded because of past or present history of asthma and 52 children were excluded as they had current symptoms and signs of upper or lower respiratory tract infection. A total of 510 children were finally included in the study and data taken up for statistical analysis (Fig. 4).

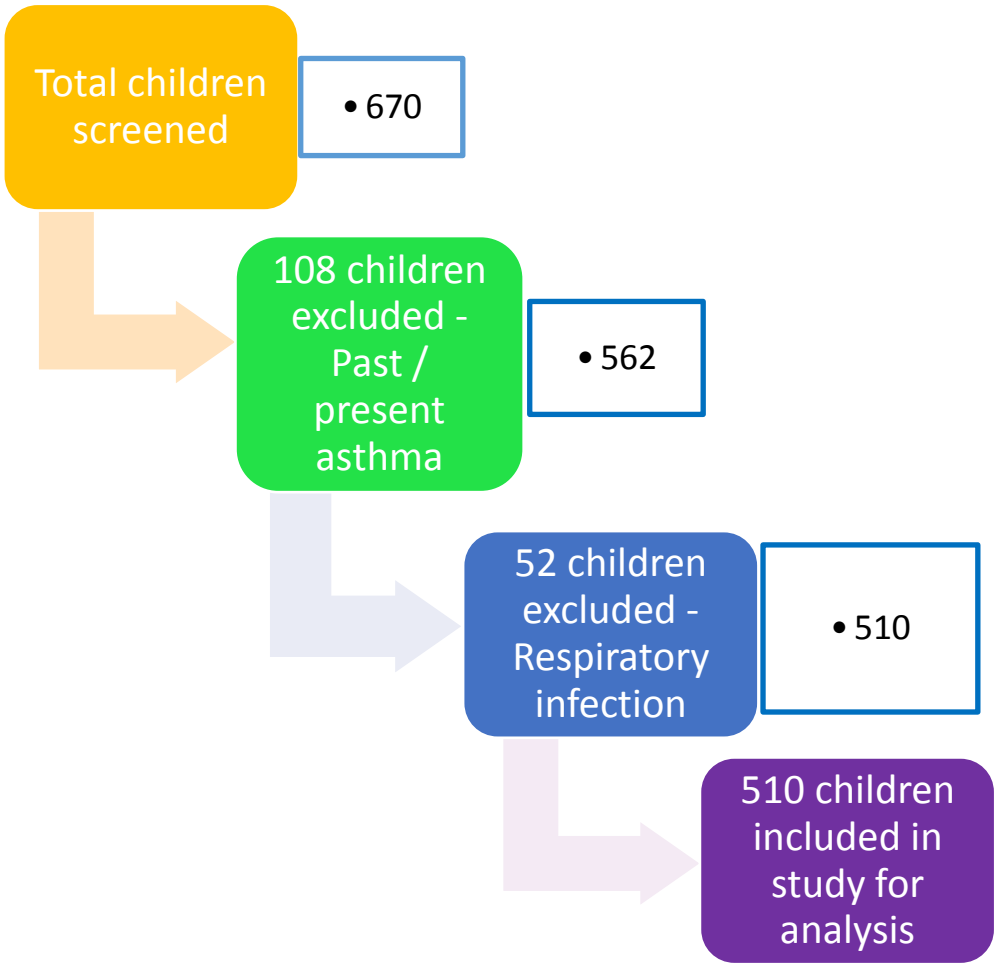
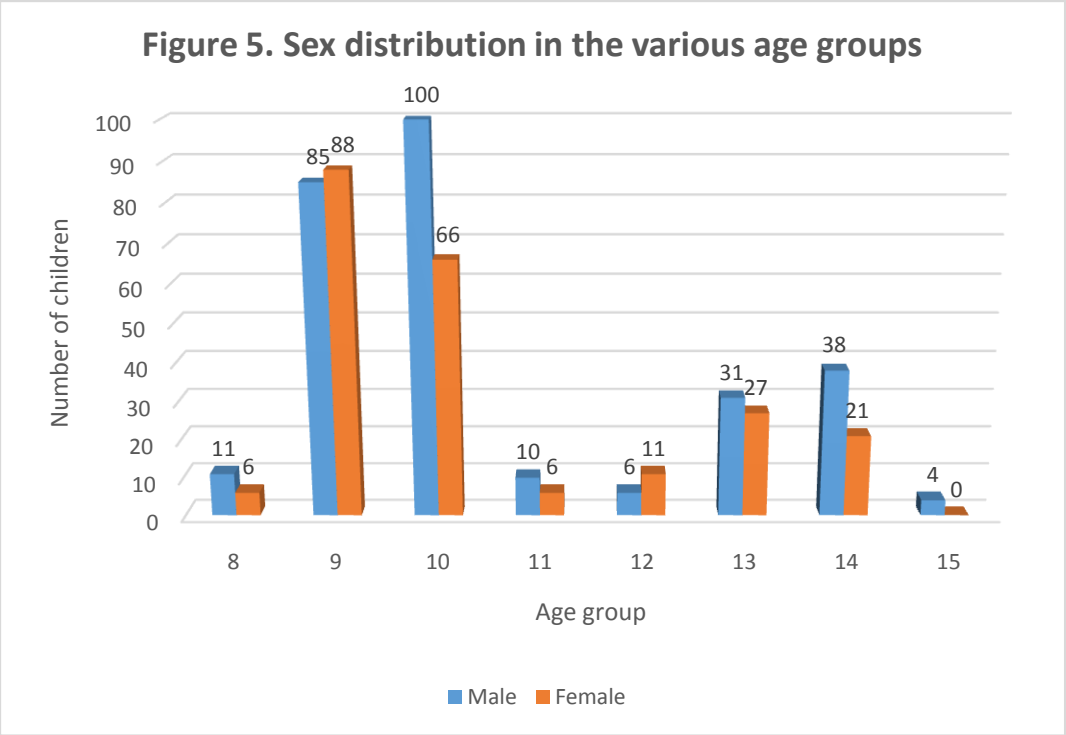


Figure 4. Study algorithm

On analysing the demographic characteristics of the population studied, it was found that the age of the students varied from 8 to 15 years with a mean of 10.54 ± 1.851 years. Age-wise, 190 (37.3%) of them fell in the pre-adolescent age group of 8-9 years, 257 (50.3%) in the early adolescent (10-13 years) age group and 63 (12.4%) in the middle adolescent group of 14-17 years of age.

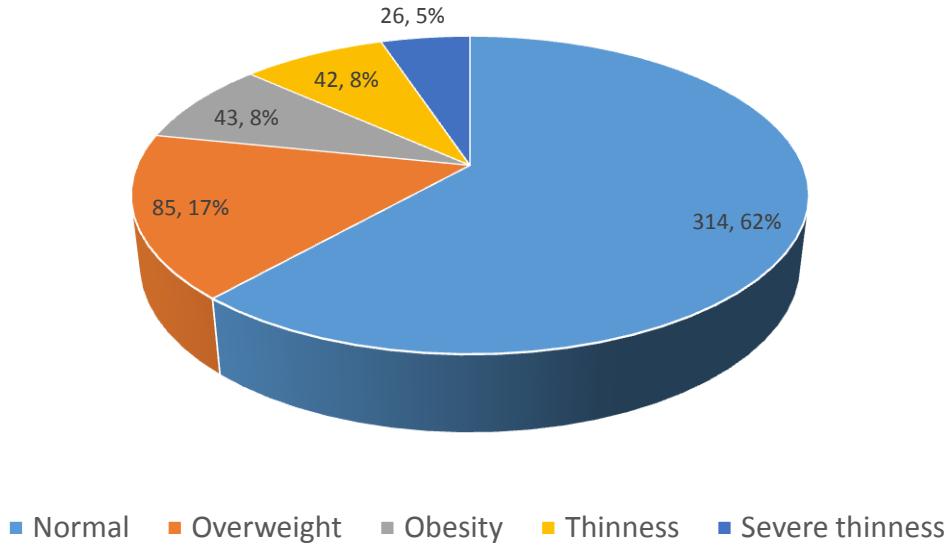
It was found that 285 (55.9%) of the students were male and 225 (44.1%) were female in the study population.

Among the males, 172 (33.6%) were pre-adolescent, 263 (51.6%) early adolescent and 75 (14.7%) were in middle adolescence. Among the females, 213 (41.8%) were in pre-adolescence, 249 (48.9%) in early adolescence and 48 (9.3%) were in middle adolescence (Fig. 5).

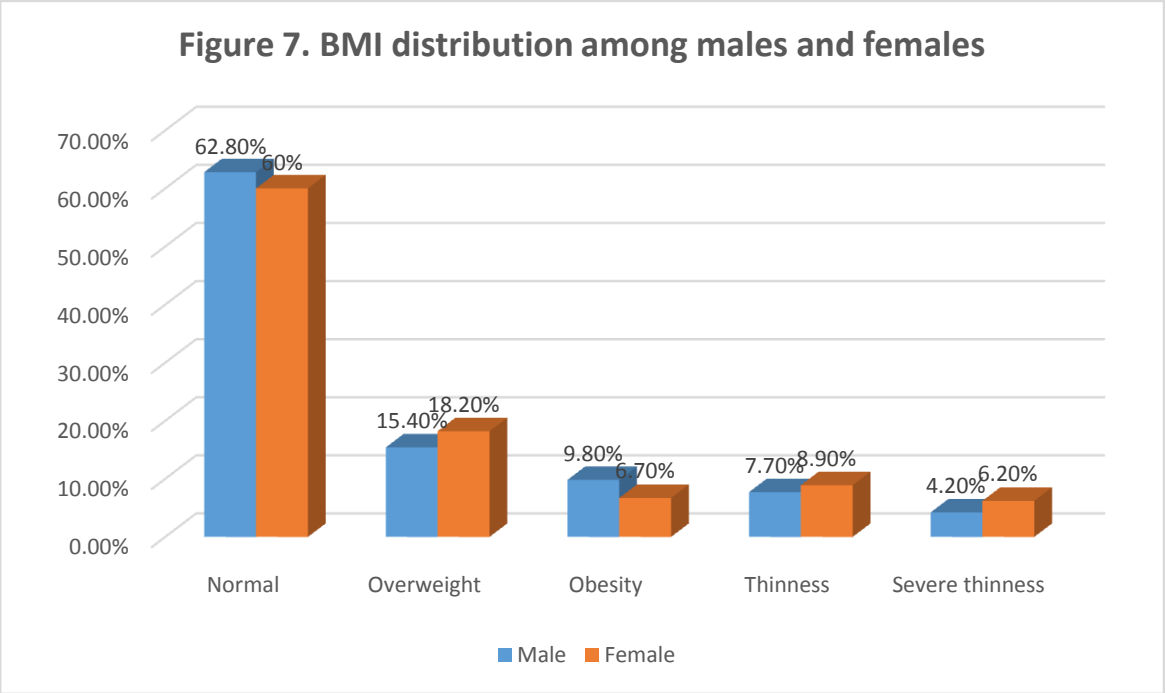


The students were classified based on the WHO BMI-for-age standards into normal weight (-2SD to +1SD), overweight (+1 to +2SD), obese (>+2SD), thinness (-2 to -3SD) and severe thinness (<-3SD). On doing so, it was found that 61.6% (n=314) of the children were normal, 16.7% (n=85) overweight, 8.4% (n=43) obese, 8.2% (n=42) thin and 5.1% (n=26) were severely thin (Fig. 6).

Figure 6. BMI distribution of the study population



Among the males, 179 (62.8%) were found to belong to the normal weight category, 44 (15.4%) overweight, 28 (9.8%) obese, 22 (7.7%) thin and 12 (4.2%) belonged to the severe thinness category. On analysing the BMI of female students, it was found that 135 (60%) of them were in the normal weight category, 41 (18.2%) were overweight, 15 (6.7%) obese, 20 (8.9%) thin and 14 (6.2%) were severely thin (Fig. 7).



The subjects were all found to be clustered around the respective schools, both located in an urban locality in west Chennai.

The study population was taken from two private higher secondary schools in west Chennai: School A (n=138; 27.1%), and School B (n=372; 72.9%).

The father's literacy status was unknown in 215 (42.2%) of the children, 42 (8.2%) of the fathers had professional degrees, 15 (2.9%) were post-graduates, 73 (14.3%) were graduates, 49 (9.6%) received higher secondary education, 103 (20.3%) high school education, 12 (2.4%) primary school education and 1 (0.2%) were uneducated.

The mother's literacy status was unknown in 236 (46.3%), professionally qualified in 9 (1.8%), 13 (2.5%) were post-graduates, 77 (15.1%) were graduates, 67 (13.2%) received higher secondary education, 93 (18.2%) high school education, 12 (2.4%) primary education and the remaining 3 (0.6%) were uneducated.

With respect to the father's employment, 40 (7.8%) were professionals, 32 (6.3%) held managerial posts, 85 (16.7%) held clerical jobs, 84 (16.5%) were labourers, 236 (46.3%) had small businesses, in 27 (5.3%), the employment was unknown and 1 (0.2%) was unemployed. The father had expired in 5 (1%) of the children.

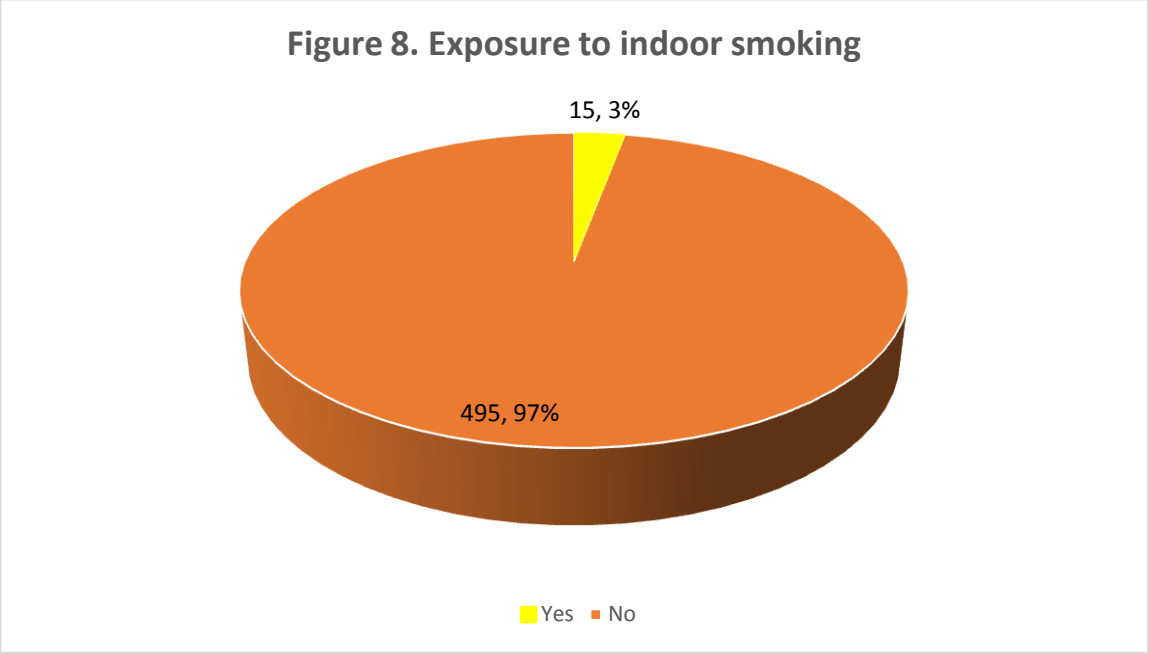
About the mother's employment details, 6 (1.2%) were professionals, 1 (0.2%) held managerial posts, 56 (11%) had clerical posts, 4 (0.8%) were labourers, 15 (2.9%) had small businesses, 401 (78.6%) were homemakers and in 26 (5.1%), the employment was unknown. (Table 2).

Table 2. Demographic characteristics of the study population.

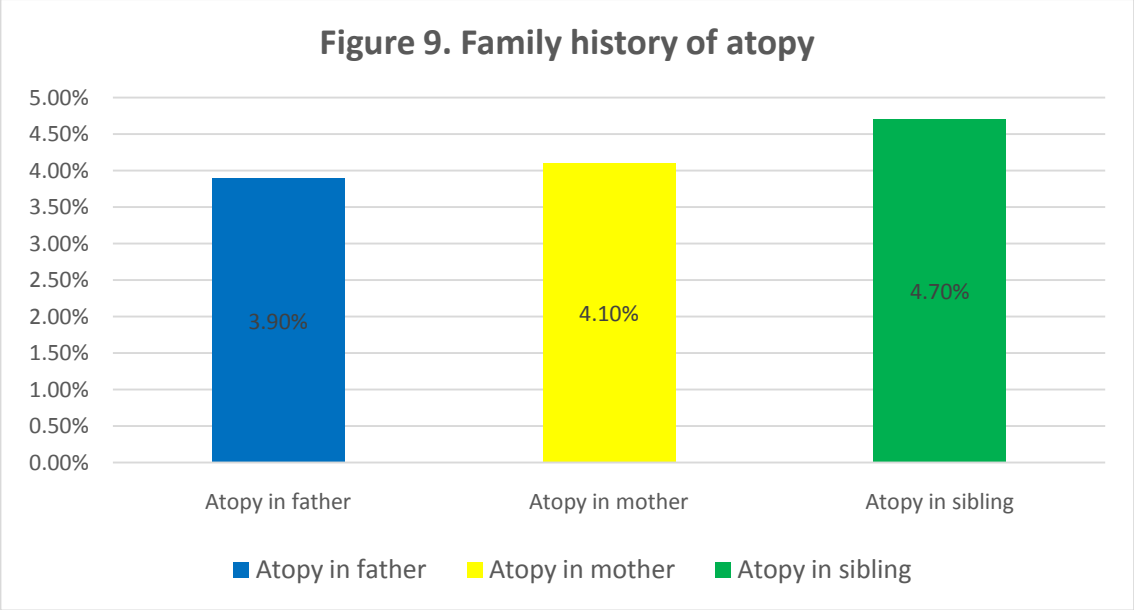
S. No.	Characteristic	Category	Number	Percentage
1.	School	School A	138	27.1%
		School B	372	72.9%
2.	Father's literacy	Professional	42	8.2%
		Post-graduate	15	2.9%
		Graduate	73	14.3%
		Higher secondary	49	9.6%
		High school	104	20.3%
		Primary	12	2.4%
		Uneducated	1	0.2%
		Unknown	215	42.2%
3.	Mother's literacy	Professional	9	1.8%
		Post-graduate	13	2.5%
		Graduate	77	15.1%
		Higher secondary	67	13.2%
		High school	93	18.2%
		Primary	12	2.4%
		Uneducated	3	0.6%
		Unknown	236	46.3%
4.	Father's employment	Professional	40	7.8%
		Managerial	32	6.3%
		Clerical	85	16.7%

		Labourers	84	16.5%
		Small business	236	46.3%
		Unemployed	1	0.2%
		Unknown	27	5.3%
		Expired	5	1%
5.	Mother's	Professional	6	1.2%
	employment	Managerial	1	0.2%
		Clerical	56	11%
		Labourers	4	0.8%
		Small business	15	2.9%
		Home-makers	401	78.6%
		Unknown	26	5.1%
		Expired	1	0.2%

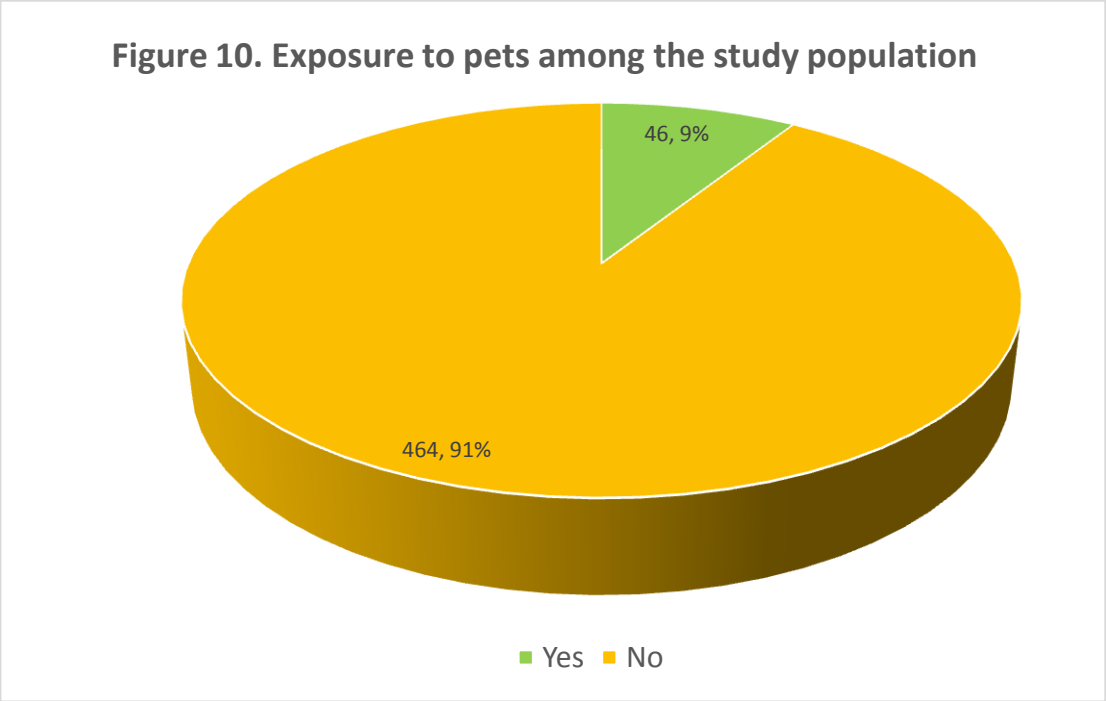
Among the children in the study population, 15 (7.6%) were exposed to indoor smoking and the rest 495 (92.4%) were not exposed (Fig. 8).



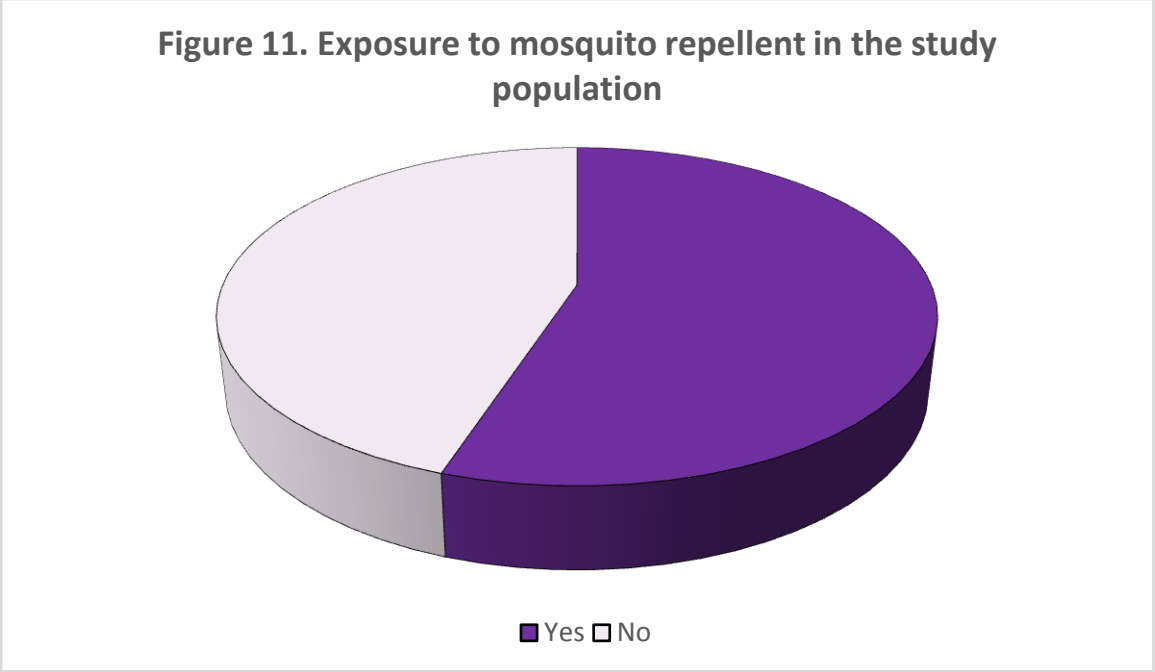
On analysing the family history of asthma, 3.9% had a history of asthma in the father, 4.1% had a history of asthma in the mother and 4.7% had a history of asthma in 1 sibling (Fig. 9).



On questioning on the presence of pets in the house, 46 (9%) of the children had pets, including dogs, cats, birds and rabbits (Fig. 10).



Among the study population, 281 (55.1%) used mosquito repellents in the house, including mosquito coils and liquidators (Fig. 11).



Analysis:

The analysis was done among 285 males with a mean PEFR of 242.22 ± 67.012 L/min and 225 females with a mean PEFR of 194.09 ± 41.824 L/min. On analysing the data using student's t-test, it was found that the peak expiratory flow rate of males was significantly higher than that of females ($p < 0.001$) (Table 3).

Table 3. Difference between the PEFR values (L/min) in males and females.

S. No.	Sex	Number of children	Mean PEFR (L/min)	Standard deviation	Standard error mean
1.	Male	285	242.44	67.012	3.969
2.	Female	225	194.09	41.824	2.788

Table 4. Results of simple linear regression analyses using peak expiratory flow rate as the dependent variable and different characteristics as independent variables.

S. No.	Independent variable	Beta coefficient	95% CI	p value
1.	Female gender	-48.350	-58.387 to -38.312	**<0.001**
2.	Age	17.542	15.051to 20.032	**<0.001**
3.	Weight	2.503	2.084 to 2.922	**<0.001**
4.	Height	2.645	2.326 to 2.964	**<0.001**
5.	BMI	2.983	1.483 to 4.484	**<0.001**
6.	Indoor smoking	0.644	-19.69 to 20.984	0.95
7.	Asthma in father	-8.735	-36.571 to 19.102	0.538
8.	Asthma in mother	-23.677	-50.802 to 3.448	0.087
9.	Asthma in sibling	0.725	-24.799 to 26.250	0.956
10.	Pets in house	-6.429	-25.289 to 12.432	0.503
11.	Use of mosquito repellent	-16.554	-27.325 to -5.783	**0.003**

Simple linear regression analysis was done using PEFR as the dependent variable and on the other hand, on a one-to-one basis independent variables as female gender, age, weight, height, BMI, exposure to indoor smoking, paternal asthma, maternal asthma, asthma in sibling, presence of pets at home and use of mosquito repellent (Table 4). Gender, age, weight, height, BMI and mosquito repellent are proven to have a significant influence on PEFR ($p<0.05$), with female gender and use of mosquito repellent having a negative correlation and age, weight, height and BMI having a positive correlation with PEFR. We find that exposure to indoor smoking, paternal asthma, maternal asthma, asthma in sibling and presence of pets at home have no significant influence on PEFR ($p>0.05$).

The beta coefficient for regression analysis between PEFR and female gender was -48.350, with a 95% confidence interval between -58.387 and -38.312. There is an expected decrease in PEFR of 48.35 for a female when compared to a male.

The beta coefficient for regression analysis between PEFR and age was 17.542, with a 95% confidence interval between 15.051 and 20.032. We expect the PEFR to increase by 17.54 for increase in age by one year. Simple regression analysis between PEFR and weight showed the beta coefficient to be 2.503, with a 95% confidence interval between 2.084 and 2.922. There is an expected increase in PEFR by 2.5 for every increase in weight by one kg. The

beta coefficient for simple regression analysis between height and PEFR was 2.645, with a 95% confidence interval between 2.326 and 2.964, implying an expected increase in PEFR by 2.64 for every unit increase in height. The beta coefficient between PEFR and BMI was 2.983, with a 95% confidence interval between 1.483 and 4.484. There is an expected increase in PEFR by 2.98 for every unit increase in BMI.

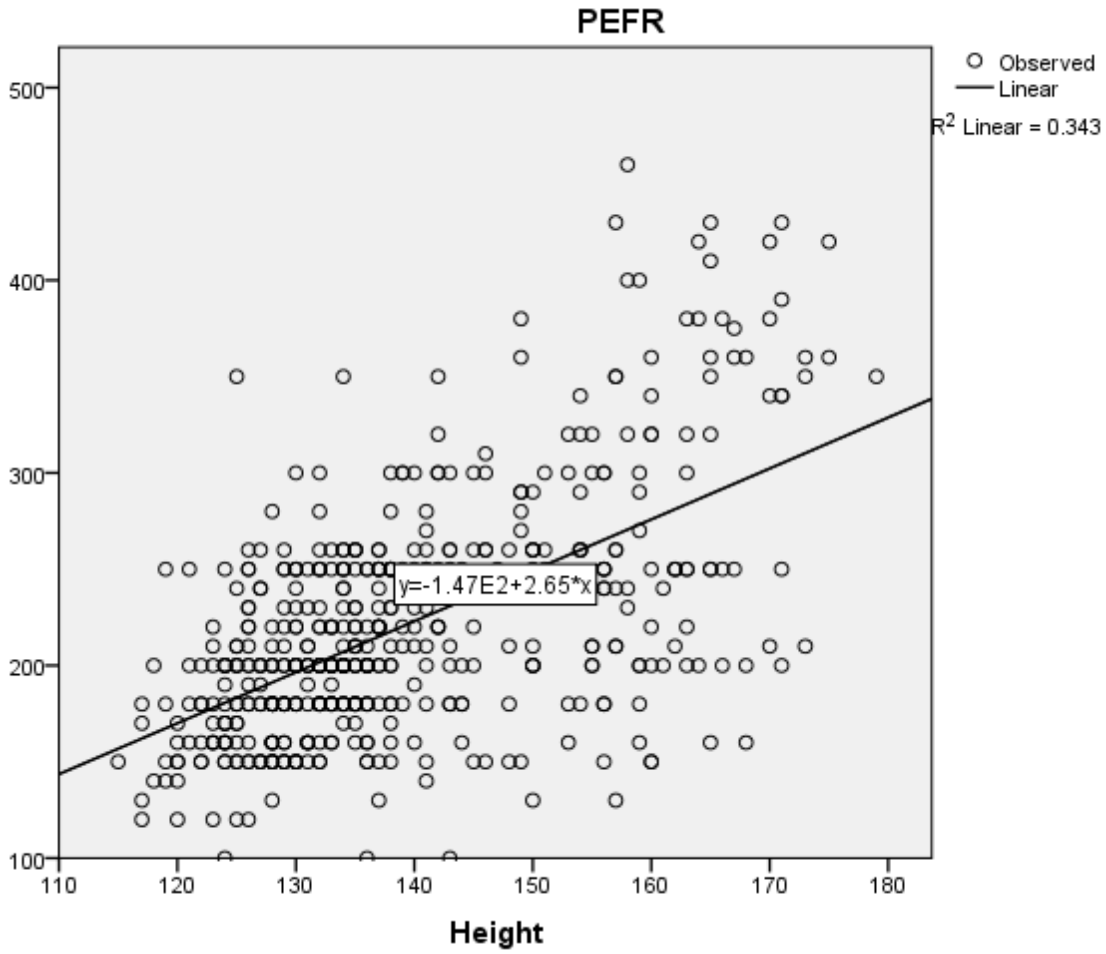


Figure 12. Scatter plot between height and PEFR in the study population.

The above scatter plot shows the positive correlation between height and PEFR with a slope of 2.65 with a few outliers outside the line of best fit, with a coefficient of r^2 of 0.34 (Fig. 7).

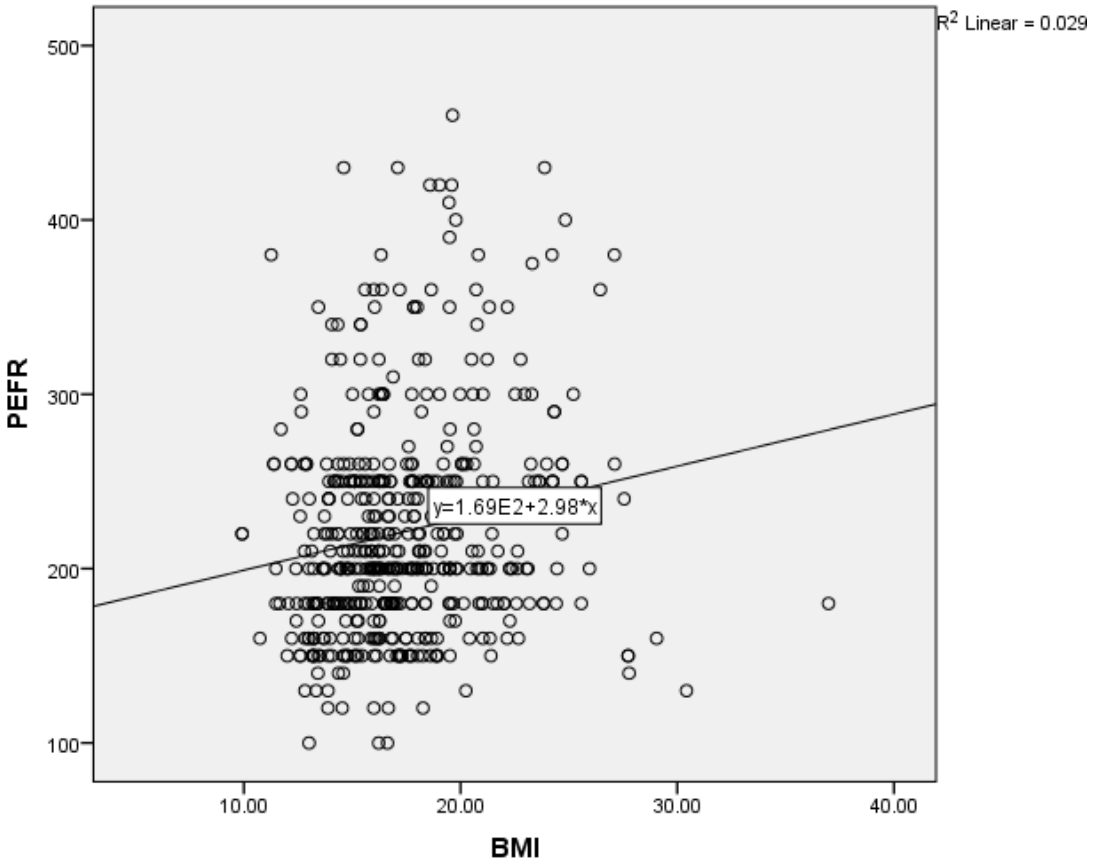


Figure 13. Scatter plot between BMI (X-axis) and PEFR (Y-axis)

The above scatter plot shows a positive correlation between BMI and PEFR with a slope of 2.98 as already derived. But it also shows a large number of outliers and the correlation is derived only by drawing the line of best fit. This implies that there is a very weak positive correlation between BMI and PEFR ($r^2 = 0.029$) (Fig. 8).

On analysing the correlation between BMI and PEFR in each of the BMI categories individually, it was found that in the normal weight category, BMI had a significant ($p<0.001$) linear correlation with PEFR ($r=0.36$), with a 95% confidence interval between 8.66 and 15.75. In the overweight category, it was found that BMI was significantly ($p<0.001$) and linearly correlated with PEFR ($r=0.435$), with a 95% confidence interval between 7.46 and 19.41. In the obese category of children, BMI was found to have no significant correlation with PEFR ($p>0.05$). Among the children falling in the category of thinness, BMI was found to have a significant ($p<0.001$) positive linear correlation with PEFR ($r=0.61$), with a 95% confidence interval from 27.93 to 66.95. Among the severely thin category of children, it was found that BMI had no significant linear correlation with PEFR. Thus, it is found that BMI has no significant correlation with PEFR in its extremes (severe thinness and obesity), whereas there is a significant correlation between the two variables in the children lying in the thin, normal and overweight categories (Table 5).

Table 5. Correlation between BMI (independent variable) and PEFR (dependent variable) in each BMI category.

S. No.	BMI category	Regression coefficient	p value	95% confidence interval	
				2.50%	97.50%
1.	Normal	**0.36**	**<0.001**	8.66	15.75
2.	Overweight	**0.435**	**<0.001**	7.46	19.41
3.	Obese	-0.104	0.506	-10.89	5.46
4.	Thinness	**0.614**	**<0.001**	27.93	66.95
5.	Severe thinness	0.02	0.92	-25.39	27.86

	Weight	BMI	PEFR	Age	Height
Weight	1	0.8	0.46	0.66	0.79
BMI	0.8	1	0.17	0.2	0.29
PEFR	0.46	0.17	1	0.52	0.59
Age	0.66	0.2	0.52	1	0.87
Height	0.79	0.29	0.59	0.87	1

Figure 14. Correlation matrix showing the correlation coefficients(r) between age, weight, height, BMI and PEFR.

In this matrix, we find that there is a high positive correlation between height and age (r=0.87), weight and age (r=0.66), weight and height (r=0.79) and BMI and weight (r=0.8). On the other hand, it is found that there is a low positive correlation between BMI and age (r=0.2) and BMI and height (r=0.29) (Fig.7).

On analysing the correlation between Peak expiratory flow rate and the variables including age, weight, height and BMI, it was found that the correlation between BMI and PEFR is low with a correlation coefficient of 0.17. Among the other variables, it is found that there is a moderate positive correlation between PEFR and height (r=0.59), age (r=0.52) and weight (r=0.46) respectively.

Next, we undertook to construct multiple linear regression models using a combination of independent variables that have no significant correlation with each other, ie non-collinear with each other ($r<0.6$).

In a multiple linear regression model (Table 6) with PEFR as the dependent variable and age, sex, BMI, parental history of asthma, use of mosquito repellents, pets at home and indoor smoking as the independent variables, it was found that female gender, age, exposure to mosquito repellent and exposure to indoor smoking had a significant contribution to PEFR

($p<0.05$). On the contrary, we found that BMI, parental history of asthma and the presence of pets at home have no significant influence on PEFR ($p>0.05$).

The coefficient B in this case for age is 16.75, with a 95% CI between 14.43 and 19.08, implying an expected increase in PEFR by 16.75 for every unit increase in age, when other variables are controlled. Coefficient B for female sex is -43.51 (95%CI= -51.94 to -35.07), meaning that there is an expected decrease in PEFR by 43.51 for a female when compared to a male, after controlling for the other variables stated above.

The coefficient B for use of mosquito repellent is -11.65 (95% CI = -20.14 to -3.16), implying an expected decrease in PEFR by 11.65 for exposure to mosquito repellent, after other variables are controlled. Coefficient B for exposure to indoor smoking is 16.30 (95%CI = 0.47 to 32.12), meaning that there is an expected increase in PEFR for exposure to indoor smoking, when other variables are controlled for. But the r^2 or variance that is explained by this model is only 0.4189 (the variability in PEFR that is explained by the variables in this model); this means there are still many more predictors of PEFR that have not been studied here. We will analyse the effect of indoor smoking further in other multiple regression models.

Also, it is interesting to note that the influence of BMI on PEFR which is significant by itself is not seen when other factors like age and sex are included. This is probably because of the more significant influence of factors like age, sex, exposure to mosquito repellents and indoor smoking.

Table 6. Results of a multiple regression analysis between PEFR as the dependent variable and age, sex, BMI, parental history of asthma, pets at home, use of mosquito repellent and exposure to indoor smoking as independent variables.

S.No.	Independent variables	Unstandardized coefficient, B	p value	95% CI	
				2.50%	97.50%
	(Intercept)	32.29	0.20	-17.09	81.67
1.	Age	16.75	**<0.001**	14.43	19.08
2.	Female gender	-43.51	**<0.001**	-51.94	-35.07
3.	BMI	1.05	0.08	-0.14	2.26
4.	Parental history of asthma	-1.69	0.83	-17.50	14.12
5.	Pets at home	7.20	0.33	-7.54	21.95
6.	Exposure to mosquito repellent	-11.65	**0.007**	-20.14	-3.16
7.	Exposure to indoor smoking	16.30	**0.04**	0.47	32.12

In another multiple regression model (Table 7), PEFR was taken as the dependent variable and sex, weight, parental history of asthma, pets at home, exposure to mosquito repellent and indoor smoking as the independent variables. In this model, we found that female gender and weight have a

significant influence on PEFR ($p<0.05$), whereas parental history of asthma, the presence of pets at home, exposure to indoor smoking and exposure to mosquito repellent are found to have no significant influence on PEFR ($p>0.05$).

The unstandardized coefficient B in this model for female sex is -43.29 (95% CI = -52.21 to -34.37), meaning that the PEFR decreases by 43.29 in a female when compared to a male after controlling for the other variables in the model. The coefficient B for weight is 2.38 (95% CI = 1.99 to 2.77), implying that the PEFR increases by 2.38 for every unit increase in weight. In this model, the influence of weight on PEFR, which was insignificant by itself, has now become significant. This is probably explained by controlling for other variables like sex and environmental factors. And exposure to mosquito repellent and indoor smoking have no significant correlation with PEFR in this model when controlling for variables including weight and sex of an individual. The r^2 or variance in PEFR explained by this model is 0.35, which is still low.

Table 7. Results of a multiple regression analysis between PEFR as the dependent variable and sex, weight, parental history of asthma, pets at home, exposure to mosquito repellent and indoor smoking as the independent variables.

S. No.	Independent variable	Unstandardized coefficient, B	p value	95% confidence interval	
				2.5%	97.5%
1.	(Intercept)	166.70	<0.001	125.73	207.67
2.	Female sex	-43.29	**<0.001**	-52.21	-34.37
3.	Weight	2.38	**<0.001**	1.99	2.77
4.	Parental history of asthma	-10.54	0.21	-27.14	6.05
5.	Pets at home	0.76	0.92	-14.82	16.33
6.	Exposure to mosquito repellent	-8.32	0.07	-17.29	0.65
7.	Exposure to indoor smoking	15.99	0.06	-0.71	32.68

In another model (Table 8), multiple linear regression was done using PEFR as the dependent variable and sex, height, parental history of asthma, pets at home, exposure to mosquito repellent and indoor smoking as the independent variables. In this model, it was found that gender, height and

exposure to mosquito repellent have a significant contribution to PEFR ($p<0.05$). On the other hand, parental history of asthma, pets at home and exposure to indoor smoking did not have any significant influence on PEFR ($p>0.05$).

The unstandardized coefficient B for sex in this model was -41.16 (95% CI = -49.72 to -33.35), denoting that there is an expected decrease in PEFR by 41.16 in a female when compared to a male, when other factors are controlled for. The coefficient B for height was 2.51 (95%CI = -0.52 to 0.63), meaning that the PEFR is expected to increase by 2.51 for every unit increase in height after controlling for other factors. The coefficient B for exposure to mosquito repellent was -8.30 (95% CI = -18.98 to 22.59), denoting an expected decrease in PEFR by 8.30 when exposed to mosquito repellent, when controlled for other variables in this model.

The r^2 or variance in PEFR explained by this model is 0.4635. This indicates the presence of still other predictors of PEFR that have not been included in this model. Since we are unable to club the significant predictors of PEFR in one single model because of collinearity, this is the probable reason for the low variance in each of these models.

Table 8. Results of a multiple regression analysis between PEFR as the dependent variable and sex, height, parental history of asthma, pets at home, exposure to mosquito repellent and indoor smoking as the independent variables.

S. No.	Independent variable	Unstandardized coefficient, B	p value	95% confidence interval	
				2.5%	97.5%
1.	(Intercept)	-113.17	<0.001	-169.73	-56.6
2.	Sex	-41.16	**<0.001**	-49.28	-33.05
3.	Height	2.51	**<0.001**	2.21	2.80
4.	Parental history of asthma	-4.63	0.55	-19.75	10.48
5.	Pets at home	3.13	0.66	-11.01	17.26
6.	Exposure to mosquito repellent	-8.30	**0.046**	-16.45	-0.16
7.	Exposure to indoor smoking	13.58	0.08	-1.49	28.65

DISCUSSION

DISCUSSION

Measuring the peak expiratory flow rate of a child, in self-monitoring of asthma and monitoring clinical response to therapy, has gained interest in the past decade. This is because of the widespread availability of handheld peak flow meters, which are relatively inexpensive compared to the conventional spirometer, coupled with the ease of performance and interpretation of the test. In contrast, the peak expiratory flow rate when measured in a healthy child is useful as a screening test to rule out airflow obstruction, but not to diagnose obstructive airway disease[6].

The peak expiratory flow rate is influenced strongly by a number of factors as described earlier. We undertook to study in particular, the correlation between body mass index and PEFR, as there were widely varying reports available in literature. We also attempted to study the influence of other factors on this measurement so that proper interpretation of the value could be done.

In summary, we found that BMI has a positive linear relationship with PEFR by itself, but on controlling for other variables like age, gender, parental history of asthma, exposure to indoor smoking and presence of pets at home, we found that BMI is not significantly related to PEFR. And in this latter model, age, gender, exposure to mosquito repellent and indoor smoking have a

significant influence on the PEFR of a child. Thus, the effect of BMI on PEFR in isolation is probably accounted for by these other factors rather than in itself. Also, we demonstrated that there is no significant influence of BMI on PEFR in the extreme values of the former, ie in obesity and severe thinness, but a significant correlation in the intermediate BMI categories.

Relationship between BMI and PEFR:

In a similar study by Pistelli et al[16] in Latium, Italy, in 1987, it was found that $\log_e$ (BMI) had a weak positive correlation with $\log_e$ (PEFR) in isolation (r=0.109) and on accounting for respiratory illnesses (r=0.114), but on controlling for $\log_e$ (FVC) as a proxy for lung size, it was found that BMI has no significant relationship with PEFR. In other studies[17,18,20,21], in simple linear regression, there was a weak positive correlation derived between BMI and PEFR (r ranging from 0.13 to 0.30).

In another study[19], the standardized regression coefficients ß ranged from 0.06 to 0.15 for $\log_e$ (BMI) with PEFR, whereas after adjusting for age and height, $\log_e$ (BMI) was found to have a weak positive correlation with PEFR (r=0.12 to 0.14). On the other hand, in a Nepalese study[22], a moderate to strong positive correlation was demonstrated in boys (r=0.69) and girls (r=0.56) but in preschool children[23], it was found that there was no significant correlation between BMI and PEFR ($p>0.05$).

Chu et al[27] studied 14,654 school-children aged between 13 and 16 years to analyse the relation between BMI and lung functions, both by International Study of Asthma and Allergies in Childhood (ISAAC) video questionnaire and by pulmonary function tests. With respect to PEFR, they found that there was a steady increase in PEFR with increasing BMI in both asthmatic and non-asthmatic males, with a significant drop in PEFR in underweight asthmatic males. But in females, there was no such drop in PEFR in underweight subjects. And there was no significant reduction or increase in PEFR in obese subjects, both male and female. However, both male and female obese subjects were found to have lung function impairment in terms of low FEV1/FVC and symptoms of asthma by ISAAC questionnaire.

Schwartz et al[28] analyzed the pulmonary function tests of 1963 healthy subjects aged between 6 and 24 years to find out any correlation with anthropometric measures and race. The study population was divided into three groups for the purpose of statistical analysis: children (aged 6 to 11 years), teens (males aged 12 to 20 years, females 12-17 years) and young adults (males 21-24 years, females 18-24 years of age). With respect to BMI and PEFR, it was found that there was no significant correlation between BMI and PEFR in the children and young adult groups ($p>0.05$), whereas there was a significant correlation in the teenage group ($r^2 = 0.187$).

Paralikar et al[29] studied 60 adolescent boys aged between 12 and 17 years from the erstwhile Baroda, Gujarat, to study the correlation between pulmonary functions and anthropometric measurements. There was no significant difference in PEFR between the obese and control groups. And no significant correlation was found between BMI and PEFR ($p > 0.05$). There were significant negative correlations between weight, BMI, waist circumference and hip circumference and FEV_1/FVC, MVV and $FEF_{25-75\%}$.

In a study from south India, Abraham et al[30] studied 2000 rural school-children aged between 6 and 12 years to study the correlation between PEFR and anthropometric measurements. It was found that there is no significant correlation between BMI and PEFR ($p>0.05$). They found that there was no significant difference between boys and girls ($p>0.05$). There were significant positive correlations drawn between age, height, weight, chest circumference and mid-upper arm circumference (correlation coefficient, r ranging from 0.65 to 0.96).

The plausible explanation for these contrasting findings is that body mass index is a measure of both body fat and lean body mass/muscle mass. Also, the effect of BMI on PEFR is found to be different in normal and overweight/obese subjects[19]. In normal subjects, the PEFR being an effort-dependent measure of lung function increases linearly with BMI with increasing strength of the respiratory muscles involved in the forceful

expiratory maneuver. But in overweight and obese subjects, the BMI is a more direct result of the subcutaneous fat deposition[16,31]. This explains the non-linear relationship between body mass index and peak expiratory flow rate.

Also, the pattern of obesity has also been found to influence the PEFR. Abdominal or central obesity is found to restrict the diaphragmatic excursion and reduces the compliance of the chest wall, increasing the intra-thoracic pressure. It has also been found to increase the airway resistance and the energy consumption of the respiratory muscles in the chest wall. This in turn increases the work of breathing required to produce an expiratory maneuver[32], hence the lower PEFR in obese subjects.

Apart from the mechanical limitation of diaphragmatic movement by fat, in obese patients, the respiratory centre has been hypothesized to be less sensitive to hypercapnea and hypoxia, additionally contributing to hypoventilation syndromes[33]. Cytokines secreted by adipose tissue including interleukin-alpha, tumour necrosis factor-alpha, leptin, interleukin-18, adiponectin, etc have also been postulated to have a role in local and systemic inflammation, adversely affecting lung function tests, playing a role in asthma[34].

On the other hand, malnutrition has also been observed to have a deleterious effect on pulmonary function tests. A study conducted on 122

children aged 5-11years in Delhi[35], India, demonstrated that FEV1 and FVC were significantly less in malnourished children when compared to healthy children. And PEFR, FEV1 and FVC had a linear relationship with body surface area of children.

In another study[36], it was proven that wasting is associated with a reduction in PEFR, while the same is not true for stunting. Another study on 39 patients[37] with cystic fibrosis were studied and it was found that the FEV1% and FVC% have a positive linear relationship with body mass index. Ong et al[21] demonstrated that lung functions were directly correlated with nutritional indices including BMI, mid-upper arm circumference, subscapular and triceps skinfold thicknesses, after correcting for sitting height and weight. Thus, a malnourished child could be falsely thought to have serious respiratory compromise if the nutritional status is not taken into consideration.

The reasons for this association are varied. The diaphragmatic muscle mass as a whole, its thickness and area have all been found to be significantly less in malnourished subjects as determined by necropsy in a set of people without respiratory illnesses[38]. In another study, it was found that the maximum contractile force of the diaphragm was significantly less in malnourished subjects when compared to healthy subjects[39]. Thus, apart from the presence of less muscle mass physically, the remnant muscle is also proposed to have a weaker contractile force. It has been studied that the muscle fiber diameters of

the external intercostals and the latissimus dorsi have a direct correlation to the % Ideal Body Weight (% IBW), as analysed from the muscle biopsies during thoracotomy. But there was no relationship between the muscle diameters and the pulmonary function tests[40].

From various animal studies[41-44], it has been hypothesized that nutritional deprivation in prenatal and early post-natal life affects various quantitative and qualitative functions of the lung, including lung volumes, alveolo-capillary surface area, connective tissue elastin and collagen content, lung phospholipid content and diffusion capacity of the lungs. When a birth cohort from Mysore, India, was followed up to study the relationship of birth weights with adult lung functions, it was seen that the birth weight was correlated with FEV1 and FVC and the head circumference at birth is directly correlated to FEV1/FVC[45]. Thus, fetal and early childhood malnutrition have a direct impact on the lung structure and functions.

The relationship between height and PEFR:

The relationship between height and peak expiratory flow rate has been well-studied and established. It has been proven that height is a strong predictor of PEFR and it has been most widely used in the construction of regression equations in various studies. These equations are different in each study, because of the unique factors affecting PEFR in each population.

A study on 421 healthy school children aged between 6 and 18 years by Nairn et al[46] in Inverness, UK, established that there is a strong direct correlation between height and PEFR (r=0.93). Another study done on 632 healthy children in the erstwhile Bombay by Chowgule et al[47] demonstrated that among the variables age, weight and height, height has the highest influence on the lung functions of a child, having a linear positive correlation.

A study done in the erstwhile Madras on 345 healthy school children by Swaminathan et al[48] revealed that the variables height (r=0.84), weight (r=0.81) and age (r=0.79) had a significant positive correlation with PEFR. It was observed that height alone can account for 75% of the variability in PEFR. Thus, regression equations and nomograms were constructed. In the study by Pistelli et al[16] in Latium, Italy, it was deduced that height is the strongest predictor of lung functions including PEF, FVC, FEV1, FEV1/FVC, $MEF_{25,}$ MEF_{50} and FEF_{25-75}, among other predictors as age, gender and BMI.

The study on 1105 Libyan adolescents by Mukhtar et al[24] found standing height was a marginally better predictor than sitting height in predicting the PEFR. A study on 1050 healthy school children aged 6 to 14 years in Babol, Iran, by Mohammadzadeh et al[49] proved by multivariate regression analysis that height was a better predictor of PEFR than weight. A number of 469 healthy south Indian children[50] were studied to demonstrate that height had a greater influence on lung functions in boys whereas in girls, age and weight

were better predictors. With respect to PEFR, the correlation coefficient of height was 0.858 in boys and 0.769 in girls.

Taksande et al[17] studied healthy school-children in rural Maharashtra to demonstrate that there is a positive correlation between PEFR and height (r=0.62 in males and r=0.42 in females). In Bellur, Karnataka, 1028 healthy school children were studied[51] and it was found that there exists a linear positive correlation between PEFR and height (r=0.88 in females and r=0.76 in males), which is greater than that of weight and gender. Regression equations and nomograms were then constructed for PEFR with respect to height.

Pulickal et al[52] studied 1403 healthy schoolchildren aged 5 to 17 years in rural Kerala, India and proved this linear correlation between PEFR and height (r=0.86 in males and r=0.76 in females) and constructed regression equations and nomograms using the same. In the erstwhile Orissa, India, 868 healthy tribal school-children were studied[18] and it was found that there is a linear positive correlation between PEFR and height (r=0.57).

A number of 708 healthy school children were studied from Berhampur, Odisha and it was found that there is a strong linear correlation between PEFR and height (r=0.82), followed in strength of correlation by weight, age and BMI. Gupta et al[53] studied a population of 1239 subjects, both children and adults. The population was divided into 4 groups for the purpose of analysis:

Males aged below 22 years, males aged over 22 years, females aged below 17 years and females aged above 17 years. The correlation between PEFR and age, weight and height were studied in each of these groups. There was a significant positive linear correlation between height and PEFR in each of these groups, but the strength of the correlation varied widely (r=0.90 in boys, 0.83 in girls, 0.28 in men and 0.27 in women.) Thus, this correlation between height and PEFR is strong in male and female children, but weak in adult men and women.

Shamssain[54] studied a group of 2000 African schoolchildren aged 6-19 years from Umtata, southern Africa. They found that PEFR, FVC and FEV1 were all significantly correlated with age and height, but no significant correlation with weight. Rosenthal et al[55] studied 772 healthy white school children from London to study the correlation between lung functions and height and puberty. They concluded that prior to onset of puberty, there is a linear relationship between lung functions and height. During puberty, there is a sudden increase observed, following which there is a decline. Linear regression could not explain this relationship adequately. Early onset of puberty resulted in increase in the lung functions, whereas delay in onset of puberty led to a decline.

The reason for the strong positive correlation between standing height (stature) and PEFR is hypothesized to be as follows. One possible explanation

is that with increasing height, the lung capacities and the peak expiratory flow rates increased due to corresponding growth of the lungs[56]. Among these, the forced vital capacity increased to a greater extent when compared to peak expiratory flow. This denotes that there is an asynchrony between the growth of the alveoli and the airways of the lung[16]. It is also hypothesized that with increasing height, there is increase in the nutritional status, which in turn is associated with greater effort at producing a forceful expiratory maneuver.

Relationship between weight and PEFR:

There is a positive linear correlation found between weight and PEFR that varies widely in different studies from insignificant to strong significant correlation. This has been found by many other researchers. Swaminathan et al[48] found a strong positive correlation between weight and PEFR (r=0.81) in their study on 345 healthy school children in Chennai. Gupta et al[53] studied a group of 1239 adults and children and demonstrated that the correlation between weight and PEFR varied from strong (r=0.88 in boys and 0.81 in girls) to weak (r=0.20 in men) to insignificant (p>0.05) in women.

Mohammedzadeh et al[49], after their study on 1050 healthy Iranian school children concluded that PEFR had a significant correlation with age, weight and height, but the correlation with weight (r^2=0.299) was lower than that with height (r^2=0.413). Taksande and colleagues studied[17] 1078 healthy school children from Wardha, Maharashtra, to demonstrate that there is a

moderate positive correlation between weight and PEFR (r=0.51 in males and 0.45 in females).

Vijayan and colleagues[50] studied 469 healthy school children aged 7 to 19 years from Chennai and demonstrated that there is a strong positive correlation between weight and PEFR (r=0.852 in boys and 0.812 in girls). Manjareeka et al[18] studied 868 healthy tribal school children from Odisha to conclude that there is no significant correlation between weight and PEFR ($p>0.05$). Nairn et al[46] studied 421 healthy school children aged between 6 and 18 years and found that there is a significant positive correlation between weight, height and body surface area. Of these, the correlation between PEFR and height was best (r=0.93), followed by body surface area (r=0.769) and then weight. Shamssain[54] found in his study that there was no significant correlation between weight and PEFR.

The possible reason behind the correlation between weight and PEFR is that weight is correlated with lean body mass (r=0.74) better than with height (r=0.31)[57]. Lean body mass is a reflection of the muscle mass of an individual. Since PEFR is a reflection of the forceful expiratory effort produced by an individual, increased muscle mass is hypothesized to cause increase in PEFR.

Relationship between age and PEFR:

We also found that there is a significant correlation between age and PEFR. This was also found in other studies. Nairn et al[46] studied 421 healthy school children in Inverness, UK, to find that PEFR was correlated with age in both boys and girls up to around 10 years, and thereafter, in boys, there was a fall in PEFR with age up to around 13 years and then there was a strong correlation with age. In girls, the PEFR demonstrated a weak positive correlation after around 11 years. This was attributed to the fact that there was a wide variation in height within the boys in the age group of 11-13 years and PEFR is much more strongly correlated with height. And in girls, due to the earlier onset of puberty and the subsequent closure of epiphyses and plateauing of height, the PEFR does not increase much further.

Taksande et al[17] found that there is a significant positive correlation between age and PEFR. Pistelli and colleagues[16] found in their study that there is a weak to moderate correlation between $\log_e$ (PEF) and $\log_e$ (age) with correlation coefficient r=0.388. They also found that age exerts a greater influence on flows than on lung volumes. In a multiple regression analysis using PEFR as the dependent variable and age and height as the independent variables, Shamssain et al[54] found that age is better correlated with PEFR (r=0.26 in boys and 0.29 in girls) than height (r=0.04 in boys and 0.01 in girls). Further, as the PEFR values were studied in this population aged 6 to 19 years, it was found that the PEFR values increased with age and then plateaued after

17 years in girls and after 18 years in boys, which corresponds to the growth arrest after completion of puberty. In girls, there was seen an increase in the slope of the FVC/age curve at around 11 years, which lasted for 2 years, which was also seen in the FVC/height curve at around 143 cm and continued for another 10 cm. In boys, this sudden acceleration was seen to begin at 13 years and continued for 2 years and in the height curve, it began at 150 cm and continued for 10cm. These changes were attributed to the growth spurt that occurs in this time period, which begins at 11 years up to 17 years in girls and at 13 years up to 18 years in boys.

Swaminathan et al[48] demonstrated that there was a strong positive correlation between age and PEFR (r=0.79). Gupta and colleagues[53] in their study found that there is a strong positive correlation between PEFR and age in children (r=0.86 in boys and 0.80 in girls) and a negative correlation in adults (r= -0.46 in men and -0.45 in women). Mukhtar et al[24] studied a group of Libyan children and adolescents and concluded that there was a moderate correlation between age and PEFR. Chowgule et al[47] concluded in their study that there is no significant contribution of age to PEFR in boys and a small but significant influence in girls. Vijayan and colleagues[50] in their study demonstrated that there is a strong positive correlation between age and PEFR (r=0.84 in boys and 0.77 in girls).

Carson et al[58] studied a group of 2828 healthy school children from Dublin, Ireland. They found that there was an increase in the slope of PEFR-age curve at 12 years in girls and at 14 years in boys, which continued for 2 to 3 years before decreasing. Similarly, they found an increase in the slope of the PEFR-height curve at 145 cm in girls and at 155 cm in girls, which continued for 15 cm and then declined. This was again attributed to puberty, but not in phase with the other somatic changes. They found that linear regression analysis blunts this peri-pubertal acceleration and tends to underestimate PEFR by around 30L/min in boys and 19L/min in girls. They find that centile charts are a better way of estimating the PEFR rather than regression equations in simple regression. Thus, the effect of age on PEFR seems to be mediated by the subsequent increase in body size and changes occurring during puberty.

Relationship between gender and PEFR:

In the present study, it was found that PEFR is significantly different between males and females and that it is significantly higher in males when compared to females. This was also found in a number of other studies. Vijayan et al[50] studied a group of 469 healthy school children aged between 7 and 19 years and deduced that PEFR is similar between boys and girls and the PEFR in boys at 18-19 years is higher than that in girls of the same age. In their study, Rosenthal and colleagues[55] found that there is no significant difference in the PEF between boys and girls below the height of 152.6 cm. Between the height of 152.6 cm and 162.5 cm, it was observed that the PEF is 7.4% greater

in girls when compared to boys. This was the height coinciding with the growth spurt in girls. And further, above the height of 162.5 cm, it was found that the PEF of males is significantly higher than that of females. This was the time coinciding with the growth spurt in boys.

Also, the thoracic dimensions including chest circumference and depth were found to increase to a greater extent in males during puberty, leading to an asynchrony in the thoracic to somatic growth, when compared to females. These, in addition to a greater increase in muscle strength contributed to the sudden increase in lung functions in boys. It was also found that FEV1/FVC (expiratory velocity / unit lung volume) was greater in younger girls when compared to boys in the same age group. This disparity disappeared by adolescence. This is postulated to be because younger girls have shorter, wider airways and smaller lung volumes[59].

Carson et al[58] studied the effect of various factors on PEFR and found that male gender has a significant positive effect on the PEFR (Regression coefficient= +20.6). Further, there was an acceleration in the PEFR with respect to age at 12 years and at 145cm in girls and at 14 years and at 155 cm in boys, which continued for 2 years and 15 cm respectively. This was attributed to the changes and growth spurt occurring during puberty. In the study by Mukhtar et al[24] on healthy Libyan children, it was found that the PEFR is significantly lower in girls when compared to boys. And the slopes of

the BMI-PEFR and the age-PEFR curves were significantly higher in boys when compared to girls, meaning that there is a stronger correlation between PEFR and BMI and age in boys when compared to girls. This was attributed to overweight and obesity in Libyan girls when compared to boys, more so in the older girls.

Nairn et al[46] in their study on Irish children, found that there is no significant difference in the PEFR with respect to height between boys and girls. However, there was a lag noticed in the rise of PEFR with age noticed after 11-14 years, which was confirmed to be due to wide variability in the height in that age group in the population studied, by comparing with the PEFR-height curve, which was found to be similar in the two genders. The finding that older boys had much higher PEFR when compared to girls of the same age group, was explained by the greater height achieved in boys by virtue of the growth spurt occurring at that time. In addition to this, it was also found that the taller boys had a greater PEFR when compared to girls of similar height. This was explained by the difference between the two sexes in the onset of puberty and the rate and manner in which they attain physical maturity. Since the pubertal stage was not assessed in this study, this association was not clearly established.

The study undertaken by Gupta et al[53] proved that the PEFR was significantly higher in males when compared to females in both adults and

children. It was also proved that smoking is not the only cause for this difference and could be due to other factors not included in their model (age, weight and height were included) or due to random variation. Shamssain et al[54] studied south African school children and it was found that there is a significant difference in the lung functions between the two sexes even after accounting for height and age.

Pistelli et al[16] in his study on lung functions, found that males had higher values of lung volumes and PEFR, but no significant difference in other flows, while FEV1/FVC was found to be higher in females. Also, no significant difference was found in the relationship between spirometric measurements and height, age and BMI. Fung et al[19] studied 1586 Chinese school children and found that the effect of body mass index on lung functions differed between boys and girls and between normal and overweight subjects. Body mass index had a significant influence on all lung functions in normal and overweight girls and normal boys, but not in overweight boys. Thus, the effect of being overweight on lung functions was found to be gender-dependent. Body mass index had a strong negative relationship with lung functions in overweight girls, whereas it had a weak positive relationship in normal girls of similar height. On the other hand, there was no significant effect of body mass index on lung functions in overweight boys. This was explained by the difference in the pattern of fat distribution in boys and girls, ie adolescent boys tend to deposit fat in the abdomen, whereas girls tend to deposit weight in the

subscapular region and extremities. Thus, overweight boys have a lower expiratory reserve volume and lower PEF and FEV1.

Relationship between PEFR and mosquito repellent exposure:

In the present study, it was found that there was a significant reduction in PEFR associated with exposure to mosquito repellent at home. Mosquito repellents of various kinds were included, ie coils, liquidators and mat. This effect was also demonstrated in other studies. Azizi et al[60] studied 1501 Malaysian school children aged between 7 and 12 years to analyse the effect of indoor air pollution on respiratory illness. It was found that there is an increased incidence of persistent wheeze and asthma associated with exposure to smoke from mosquito coils for at least three nights per week. There was no significant relationship between exposure to smoke produced by mosquito mats and respiratory illness. Also, it was predicted that 29% of wheeze and respiratory illness could be reduced by preventing exposure to mosquito coil smoke.

Another cross-sectional study by the same authors[61] done on 1414 children aged 7 to 12 years demonstrated no decrease in spirometric or peak flow measurements associated with exposure to mosquito repellent. A hospital-based study done in Kuala Lumpur[62] on 158 children aged 1 month to 5 years for first episode of wheeze revealed that there was a definite risk of asthma associated with exposure to passive smoking (Odds ratio, OR=1.91) and

exposure to smoke from mosquito coils (OR=1.73). But they failed to demonstrate any association between exposure to aerosolized mosquito repellent and asthma. Venkatesh et al[63] studied 90 subjects aged between 15 and 60 years to analyse the effect of mosquito coils and liquidators on lung functions. It was found that there was a decrease in FEV1 and FVC in subjects exposed to mosquito coils and liquidators when compared to controls. There was a significant decrease in PEFR, FEV1, FVC and $FEF_{25-75\%}$ with increasing duration of exposure to mosquito coils and liquidators.

It has been found in studies[64] that there is an enormous amount of fine particulate matter, aromatic and aliphatic hydrocarbons and toxic gases like formaldehyde vapours released into the environment on burning one mosquito coil, which is equivalent to 75 to 137 cigarettes. Thus, exposure to mosquito repellent can have disastrous consequences on the health of the individuals involved.

CONCLUSION

CONCLUSION

In conclusion, we find that there is a weak but significant influence of BMI on the PEFR of a child, which is not seen when age, gender and exposure to mosquito repellent are accounted for. Thus, the influence of BMI on the PEFR seems to be indirectly mediated by other factors like age and gender. BMI, in its extremes, has no significant influence on PEFR, whereas there is a significant influence in the intermediate BMI categories.

On the other hand, age, weight, height, gender and exposure to mosquito repellent exert significant influence on PEFR, which is seen even after controlling for other variables.

LIMITATIONS

LIMITATIONS

- The study could not differentiate between lean body mass (LBM) and percentage body fat (%BF) in the contribution to BMI, because of technical limitations in measurement of LBM and %BF. This could have predicted the influence on PEFR better.
- Statistical analysis of PEFR with respect to age and height in the form of centiles would have better characterized the non-linear relationship between PEFR and age and height. But this was not possible because of inadequate sample size.
- The accuracy of answers to the questionnaire could have been improved if parents were available to answer the question, for better understanding and knowledge.
- Adequate orientation and practice to perform the forced expiratory maneuver were not possible because of constraints of time.
- Non-availability of official data about air pollution levels in each residential area in Chennai hindered the analysis of any association between air pollution and PEFR.
- Quantifying the exposure to mosquito repellent in terms of hours per day and total number of years used, ventilation and crowding in the house were not possible to analyse the effect on PEFR.
- Quantifying the exposure to indoor smoking in terms of pack years was not possible because of lack of data.

- Since the study was conducted in two urban private schools, it was not able to compare the scenario with other settings like rural and government schools with different socioeconomic status and air pollution levels.
- We could not assess the socioeconomic status of the children due to lack of awareness of the parents' literacy, occupation and income.

FUTURE RECOMMENDATIONS

FUTURE RECOMMENDATIONS

- Studies on the effect of lean body mass and percentage body fat on PEFR
- Studies on the effect of mosquito repellent on PEFR, with quantitative estimation of the exposure with respect to number of hours per day, windows and doors closed/open, ventilation and overcrowding in the room and total number of years used, brand and constituents of the mosquito repellent preparation used
- Studies using questionnaires filled out by the parents to study the socioeconomic status and exposure to indoor smoking and mosquito repellent
- Studies in two or more different settings including rural and urban, low, middle and high socioeconomic status to study PEFR and its predictors

REFERENCES

REFERENCES

1. Donald KW. Definition and assessment of respiratory function. BMJ. 1953;1(4807):415.
2. Miller MR, Crapo R, Hankinson J, Brusasco V, Burgos F, Casaburi R et al. General considerations for lung function testing. Eur Respir J. 2005; 26(1):153-61.
3. Wilde M, Nair S, Madden B. Pulmonary function tests-a review. Care Crit Ill. 2007; Dec 23(6):173-7.
4. Tiffeneau R, Pinelli A. Circulating and retained air in the exploration of pulmonary ventilatory function. Paris Med. 1947;133:624–631.
5. Ranu H, Wilde M, Madden B. Pulmonary function tests. Ulster Med J. 2011;80(2):84.
6. Slieker MG, van der Ent CK. The diagnostic and screening capacities of peak expiratory flow measurements in the assessment of airway obstruction and bronchodilator response in children with asthma. Monaldi Arch Chest Dis. 2003;59:155-9.
7. Meltzer AA, Smolensky MH, D'Alonzo GE, Harrist RB, Scott PH. An assessment of peak expiratory flow as a surrogate measurement of FEV1 in stable asthmatic children. Chest. 1989; 96: 329-333.
8. McNaughton JP. Portable peak flow meters. Eur Respir J. 1997; 10 (Suppl 24): 26s-28s.

9. Quanjer PH, Lebowitz MD, Gregg I, Miller MR, Pedersen OF. Peak expiratory flow: conclusions and recommendations of a Working Party of the European Respiratory Society. Eur Respir J 1997; 10 (Suppl 24): 2s-8s.
10. Paggiaro PL, Moscato G, Giannini D, Di Franco A, Gherson G. Relationship between peak expiratory flow (PEF) and FEV1. Eur Respir J 1997; 10: Suppl. 24, 39s-41s.
11. Kannisto S, Vanninen E, Remes K, Korppi M. Use of a pocket-sized turbine spirometer in monitoring excercise-induced bronchospasm and bronchodilator response in children. Pediatr Allergy Immunol 1999; 10:266-271.
12. Collins LC, Hoberty PD, Walker JF, Fletcher EC, Peiris AN. The effect of body fat distribution on pulmonary function tests. Chest. 1995 May;107(5):1298-302.
13. Raju PS, Prasad KVV, Ramana YV, Ahmed SK, Murthy KJR. Study on lung function tests and prediction equations in Indian male children. Indian Pediatr. 2003; 40:705-711.
14. Burr ML, Eldridge BA, Borysiewicz LK. Peak expiratory flow rates before and after exercise in schoolchildren. Arch Dis Child. 1974; 49: 923.
15. Carson JW, Hoey H, Taylor MR. Growth and other factors affecting peak expiratory flow rate. Arch Dis Child. 1989; 64(1): 96-102.

16. Pistelli R, Brancato G, Forastiere F, Michelozzi P, Corbo GM, Agabiti N, et al. Population values of lung volumes and flows in children: effect of sex, body mass and respiratory conditions. Eur Respir J. 1992;5(4):463–70.
17. Taksande A, Jain M, Vilhekar K, Chaturvedi P. Peak expiratory flow rate of rural school children from Wardha district, Maharashtra in India. World J Pediatr. 2008;4(3):211–4.
18. Manjareeka M, Mishra J, Mishra S, Mishra J, Nanda S. Assessment of peak expiratory flow rate in preadolescent children of sub-tribal communities in Odisha. Int J Clin Exp Physiol. 2014;1(2):120.
19. Fung KP, Lau SP, Chow OK, Lee J, Wong TW. Effects of overweight on lung function. Arch Dis Child. 1990;65(5):512–5.
20. Choudhuri D, Sutradhar B. Pulmonary function of adolescents from Tripura, a North-eastern state of India. Lung India. 2015;32(4):353.
21. Ong TJ, Mehta A, Ogston S, Mukhopadhyay S. Prediction of lung function in the inadequately nourished. Arch Dis Child. 1998;79(1): 18–21.
22. Dhungel KU, Parthasarathy D, Dipali S. Peak expiratory flow rate of Nepalese children and young adults. Kathmandu Univ Med J. 2008;6(3):346–54.
23. Kalhoff H, Breidenbach R, Smith HJ, Marek W. Spirometry in preschool children: time has come for new reference values. J Physiol Pharmacol. 2009;60(Suppl 5):67–70.

24. Mukhtar M-SR, Rao GMM, Morghom LO. Peak expiratory flow rates in Libyan adolescents. Indian J Physiol Pharmacol. 1989;33(4):223–7.
25. Mishra S, Behera AK, Ravichandra KR, Sethy G, Soren NN. Study of peak expiratory flow rate of school children of south Odisha. Scholars Acad J Biosci. 2015; 3(5):429-433.
26. Ülger Z, Demir E, Tanaç R, Göksen D, Gülen F, Darcan S et al. The effect of childhood obesity on respiratory function tests and airway hyperresponsiveness. Turk J Pediatr. 2006;48(1):43.
27. Chu YT, Chen WY, Wang TN, Tseng HI, Wu JR, Ko YC. Extreme BMI predicts higher asthma prevalence and is associated with lung function impairment in school-aged children. Pediatr Pulmonol. 2009, 44: 472-9.
28. Schwartz JD, Katz SA, Fegley RW, Tockman MS. Analysis of spirometric data from a national sample of healthy 6- to 24-year-olds, (NHANES II). Am Rev Respir Dis.1988;138:1405-1414.
29. Paralikar SJ, Kathrotia RG, Pathak NR, Jani MB. Assessment of pulmonary functions in obese adolescent boys. Lung India. 2012;29(3):236-40.
30. Abraham B, Baburaj S, Patil RB, Mohandas MK, Ruhman S, Raj S. Peak expiratory flow rate nomogram in relation to anthropometric determinants of south Indian school children. Indian J Child Health. 2014;1(2):44-48.

31. Schoenberg JB, Beck GJ, Bouhuys A. Growth and decay of pulmonary function in healthy blacks and whites. Respir Physiol. 1978;33(3): 367-393.
32. Luce JM. Respiratory complications of obesity. Chest. 1980;78(4): 626-631.
33. Lourenço RV. Diaphragm activity in obesity. J Clin Invest. 1969;48(9):1609.
34. Goswami B, Roy AS, Dalui R, Bandyopadhyay A. Peak expiratory flow rate – a consistent marker of respiratory illness associated with childhood obesity. Am J Sports Sci Med. 2014;2(1):21-26.
35. Faridi MMA, Gupta P, Prakash A. Lung functions in malnourished children aged five to eleven years. Indian Pediatr. 1995;32:35–35.
36. Primhak R, Coates FS. Malnutrition and peak expiratory flow rate. Eur Respir J. 1988;1(9):801–803.
37. Gozdzik J, Cofta S, Piorunek T, Batura-Gabryel H, Kosicki J. Relationship between nutritional status and pulmonary function in adult cystic fibrosis patients. J Physiol Pharmacol. 2008;59(suppl 6):253–260.
38. Arora NS, Rochester DR Effect of body weight and muscularity on human diaphragm muscle mass, thickness, and area. J Appl Physiol Respir Environ Exerc Physiol. 1982;52:64-70.
39. Rochester DF, Arora NS, Braun NM. Maximum contractile force of human diaphragm muscle, determined in vivo. Trans Am Clin Climatol Assoc. 1982;93:200.

40. Hards JM, Reid WD, Pardy RL, Pare PD. Respiratory muscle fiber morphometry: Correlation with pulmonary function and nutrition. Chest. 1990;97:1037–44.
41. Lechner AJ. Perinatal age determines the severity of retarded lung development induced by starvation. Am Rev Respir Dis. 1985;131: 638–43.
42. Gaultier C. Malnutrition and lung growth. Pediatr Pulmonol 1991;10:278–86.
43. Riley DJ, Thakkervaria S. Effect of diet on lung structure, connective tissue metabolism and gene expression. J Nutr. 1995;125:S1657–60.
44. Zhang HJ, German BJ. Dietary modulation of phospholipid fatty acid composition and lipoxygenase products in mouse lung homogenates. Lipids. 1996;31:19–25.
45. Stein CE, Kumaran K, Fall CH, Shaheen SO, Osmond C, Barker DJ. Relation of fetal growth to adult lung function in south India. Thorax. 1997 Oct; 52(10): 895–899.
46. Nairn JR, Bennet AJ, Andrew JD, Macarthur P. A study of respiratory function in normal school children: The peak flow rate. Arch Dis Child. 1961 Jun; 36(187): 253–258.
47. Chowgule RV, Shetye VM, Parmar JR. Lung function tests in normal Indian children. Indian Pediatr. 1995;32:185–185.
48. Swaminathan S, Venkatesan P, Mukunthan R. Peak expiratory flow rate in south Indian children. Indian Pediatr. 1993;30(2):207-11.

49. Mohammadzadeh I, Gharagozlou M, Fatemi SA. Normal values of peak expiratory flow rate in children from the town of Babol, Iran. Iran J Allergy Asthma Immunol. 2006;5(4):195–198.

50. Vijayan VK, Reetha AM, Kuppurao KV, Venkatesan P, Thilakavathy S. Pulmonary functions in normal south Indian children aged 7 to 19 years. Indian J Chest Dis Allied Sci. 2000;42(3):147–156.

51. Pulickal AS, Fernandez GV. Peak expiratory flow rate in healthy rural south Indian school children predicted from body height. Indian J Public Health 2007;51:117–119.

52. Manjunath CB, Kotinatot SC, Babu M. Peak expiratory flow rate in healthy rural school going children (5-16 years) of Bellur region for construction of nomogram. J Clin Diagn Res. 2013;7(12):2844–2846.

53. Gupta CK, Mathur N. Statistical models relating peak expiratory flow rates to age, height, and weight in men and women. J Epidemiol Community Health. 1982;36:64-67.

54. Shamssain MH. Forced expiratory indices in normal black Southern African children aged 6-19 years. Thorax 1991;46:175-9.

55. Rosenthal M, Bain SH, Cramer D, Helms P, Denison D, Bush A et al. Lung function in white children aged 4 to 19 years: I-Spirometry. Thorax. 1993;48:794-802.

56. Cotes JE. Lung function: assessment and application in medicine. Oxford: Blackwell Scientific. 1993;4:33-34.

57. Hume R. Prediction of lean body mass from height and weight. J Clin Pathol. 1966;19:389.

58. Carson JWK, Hoey H, Taylor MRH. Growth and other factors affecting peak expiratory flow rate. Arch Dis Child. 1989;64:96-102.

59. Hibbert M, Couriel JM, Landau LI. Changes in lung, airway and chest wall function in boys and girls between 8 and 12 years. J Appl Physiol. 1984;57:304-8.

60. Azizi BHO, Henry RL. The effects of indoor environmental factors on respiratory illness in primary school children in Kuala Lumpur. Int J Epidemiol. 1991;20(1):144-150.

61. Azizi BHO, Henry RL. Effects of indoor air pollution on lung function of primary school children in Kuala Lumpur. Pediatr Pulmonol. 1990;9:24–29.

62. Azizi BH, Zulkifli HI, Kasim S. Indoor air pollution and asthma in hospitalized children in a tropical environment. J Asthma. 1995;32(6):413-8.

63. Venkatesh S, Puneeth M. Effects of mosquito repellents on pulmonary functions. J Evol Med Dent Sc. 2014;3(39):9892-9896.

64. Liu W, Zhang J, Hashim JH, Jalaludin J, Hashim Z, Goldstein BD. Mosquito coil emissions and health implications. Environ Health Perspect. 2003;111(12):1454-1460.

ANNEXURES

PROFORMA

Name:

Age: Sex:

Address:

Family details:

	Father	Mother
Literacy		
Employment		
Smoking inside the house		
H/o Atopy/ asthma		
H/o atopy/asthma in siblings		

House details:

Use of mosquito mats:

Presence of pets(specify):

Presence of factory in neighbourhood:

Presence of paddy field:

History:

H/o Wheeze:

H/o nebulization in the past:

H/o hospitalization for Respiratory infection:

H/o atopy:

H/o daytime somnolence:

H/o snoring:

Anthropometry:

Weight: **Height:**

PEFR:

1st reading:

2nd reading:

3rd reading:

Examination:

Retractions: Tachypnea:

CVS: RS:

Chest wall or thoracic deformity:

INFORMATION TO PARTICIPANTS

Investigator: Dr. Andrea Josephine R

Name of the Participant:

Title: "A study on the correlation between Body Mass Index and Peak expiratory flow rate in school-going children aged between 8 and 15 years in Chennai, India"

You are invited to take part in this research study. We have got approval from the IRB. You are asked to participate because you satisfy the eligibility criteria.

What is the Purpose of the Research:

To study the correlation between Body mass index and peak expiratory flow rate in school going children between 8 and 15 years of age

Procedure:

The weight and height of each child are recorded. The peak expiratory flow rate of the child is measured by asking him/her to blow as fast and hard as he/she can into a hand-held instrument called the mini Wright's peak flow meter. Three readings are taken and the best of three is chosen for analysis.

Benefits, Discomforts and risks:

This intervention has been shown to be well tolerated as shown by previous studies. And if you do not want to participate you will have alternative of setting the standard treatment and your safety is our prime concern.

Time :

Date :

Place :

Signature / Thumb Impression of Parent

Parent Name:

Student Name:

Signature of the Investigator : _____

Name of the Investigator : _____

PATIENT CONSENT FORM

"A study on the correlation between Body Mass Index and Peak expiratory flow rate in school-going children aged between 8 and 15 years in Chennai, India"

Study centre: An urban school in Chennai

Participant name: Age: Sex:

I confirm that I have understood the purpose of procedure for the above study. I have had the opportunity to clarify all my queries and doubts and they have been answered to my satisfaction.

The investigator explained very well about the procedure and I am made aware of the safety, advantages and disadvantages of the technique.

I understand that my participation in the study is purely voluntary and that I am free to withdraw at anytime without giving any reason.

I have understood that the investigator, regulatory authorities and the ethics committee will have access to my health records both in respect to current study and any further research that may be conducted in relation to it, even if I decide to withdraw from the study. I have understood that my identity will not be revealed in anyway and information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from the study.

Without any compulsion I am willing to give consent for the participation of my child in this study.

Date: Signature / thumb impression of parent

Place: Parent name:

Student name:

Signature of the investigator:

Name of the investigator:

ஆய்வு பற்றிய தகவல் படிவம்

இடம் :

தொழிலாளர் நலகாப்பீட்டு மருத்துவமனை மற்றும் மருத்துவ
பட்டமேற்படிப்பு ஆராய்ச்சி நிறுவனம்
கே.கே.நகர்
சென்னை-600 078.

ஆய்வாளர்: மரு.ஆன்ரியா ஜோஸ்பின்.ரெ.

ஆய்வு :

"சென்னையில் வசிக்கும் 8 முதல் 15 வயதுள்ள பள்ளிக்குச் செல்லும் சிறுவர் மற்றும் சிறுமிகளின் உடல் எடை உயரம் விகித குறியீடு மற்றும் உச்சவெளி மூச்சு ஓட்டவிகிதம் இவற்றிற்கான தொடர்பைப் பற்றிய ஆய்வு"

மறுப்பதற்கான உரிமை மற்றும் நம்பகத்தன்மை:

இந்த ஆய்வில் தங்கள் குழந்தை பங்கேற்பதை மறுக்க முழு உரிமை உள்ளது. இந்த ஆய்வுக்காக நீங்கள் வழங்கும் அனைத்து தகவல்களும் ரகசியமாக பாதுகாக்கப்படும். எந்த இடத்திலும் உங்கள் பெயர் பயன்படுத்தபடமாட்டாது.

நடைமுறைகள்:

தங்கள் குழந்தை இந்த ஆய்வில் பங்கேற்க நீங்கள் விருப்பம் தெரிவித்தால், **உடல் பரிசோதனை கீழ்க்கண்டவாறு செய்யப்படும்:**

முதலில் குழந்தைகளின் உயரம் காலணி எதுவும் இல்லாமல் கணக்கிடப்படும். காலணி இல்லாமல் மிதமான ஆடையுடன் எடை கணக்கிடப்படும். உடல் எடை பற்றிய அட்டவணை உயரம் மற்றும் எடைக்கேற்றப்படி கணக்கிடப்படும்.

உச்சவெளி மூச்சு ஓட்டவிகிதம் **"மினிரைட்ஸ் பீக் ஃப்ளோமீட்டர்"** என்னும் கருவியினால் கணக்கிடப்படும் அனைத்து குழந்தைகளும் நிற்கும் நிலையில் இந்த ஆய்வு நடத்தப்படும். ஆய்விற்கு முன்பாக இந்த ஆய்வைப் பற்றிய அனைத்து நிகழ்வையும் அவர்களுக்கு தகுந்தபடி எடுத்துரைக்கப்படும். ஒவ்வொரு குழந்தைகளையும் மூச்சை நல்ல ஆழமாக எடுக்கச் சொல்லி அந்த கருவியின் உதவியினால் அவர்களால் கடினமாகவும், அதிகமாகவும் எவ்வளவு முடியுமோ அதற்கேற்றப்படி கணக்கிடப்படும். மூன்று முறை செய்து அவற்றில் ஒன்றை ஆய்விற்கு எடுத்துக்கொள்ளப்படும்.

யாரை தொடர்புகொள்வது?

இந்த ஆய்வு குறித்து சந்தேகங்களை எப்பொழுது வேண்டுமானாலும் கீழ்க்கண்ட மருத்துவரை தொடர்புகொண்டு தெளிவு படுத்திகொள்ளலாம்.

மருத்துவர் பெயர்: மரு. ஆன்ரியா ஜோஸ்பின். ரெ.
அலைபேசி எண்: 95977 97613

ஆய்வில் பங்கேற்பதற்கான ஒப்புதல் படிவம்

நான்_____

தகவல் படிவத்தில் இருந்த தகவல்களை படித்து அறிந்தேன்/ படிக்க கேட்டறிந்தேன். எனக்கு கொடுத்த தகவல்களையும் படித்து புரிந்து கொண்டேன். என்னுடைய சந்தேங்களை தீர்த்துக் கொள்ள எனக்கு வாய்ப்பளிக்கப்பட்டது. எனது கேள்விகளுக்கு திருப்தி அளிக்கும் வகையில் பதில்கள் வழங்கப்பட்டன.

எனது குழந்தை **"உடல் எடை பற்றிய அட்டவணை மற்றும் உச்சவெளி மூச்சு ஓட்டவிகிதம் இவற்றிற்கான தொடர்பைப் பற்றிய ஆய்வு"** என்ற ஆய்வில் கலந்து கொள்ள எவ்வித தயக்கமும் வற்புறுத்தலும் இல்லாமல் முழு மனதுடன் ஒப்புதல் அளிக்கிறேன்.

1. ஒப்புதல் படிவம் எனக்கு விளக்கி கூறப்பட்டது.
2. இந்த ஆய்வு முறை குறித்து எனக்கு விளக்கி கூறப்பட்டது
3. என் உரிமைகள் மற்றும் பொறுப்புகளை ஆய்வாளர் எனக்கு விளக்கி கூறியதை புரிந்துகொண்டேன்.
4. இந்த ஆய்வு பாதுகாப்பானது என்பதை புரிந்துகொண்டேன்.
5. நான் தற்போது வேறு எந்த ஒரு ஆய்விலும் பங்கேற்வில்லை என்று உறுதி அளிக்கிறேன்.
6. இந்த ஆய்வில் இருந்து விலகுவதால் எனது குந்தையின் சிகிச்சைக்கு எவ்வித பாதிப்பும் வராது என்பதை அறிவேன்.

இந்த ஆய்வின் இறுதியில் கிடைக்கும் தகவல்களை ஆய்வாளர் உயர் மட்ட குழுவினருக்குத் தெரியபடுத்துவதையும் உள்மருத்துவ இதழில் வெளியிடவும் அனுமதிக்கிறேன்.

7. தகவல்கள் பதிவுசெய்யப்படும் பொழுது எனது குழந்தையின் பெயர் ரகசியமாக வைக்கப்படும் என்பதை அறிவேன்.
8. இந்த ஆய்வில் எனது குழந்தை பங்கேற்க நான் முழு மனதுடன் சம்மதிக்கிறேன்.

பங்கேற்பாளரின் பெயர்:_____

பங்கேற்பாளரின் கையொப்பம்: _____

தேதி:

படிப்பறிவில்லாதவர் எனில் பங்கேற்பாளருக்கு தகவல் படிவம் தெளிவாக படித்து காண்பிக்கப்பட்டது மற்றும் அவருக்குரிய சந்தேகங்களுக்கு விளக்கம் கேட்க வாய்ப்பளிக்கப்பட்டது என்பதற்கு நான் சாட்சியம் அளிக்கிறேன்.

பங்கேற்பாளர் முழு சுதந்திரத்துடன் சம்மதம் தெரிவித்தார் என்பதை உறுதி செய்கிறேன்.

தேதி:

பங்கேற்பாளரின் இடது கை பெருவிரல் பதிவு_____

சாட்சி கையொப்பம் _____

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
1	Vishali	9	2	Ekkatuthangal	Vel	999	5	999	5	2	2	1	1	2	2	38	135	200
2	Kiyasudeen	9	1	KK Nagar	Vel	999	3	999	7	2	2	2	2	2	1	61	148	180
3	Madhu Shree	9	2	KK Nagar	Vel	999	5	999	7	2	2	2	2	1	1	26	129	210
4	Krishitha	9	2	KK Nagar	Vel	999	3	999	7	2	2	2	2	2	1	30	132	150
5	Sowdha	9	2	MGR Nagar	Vel	8	3	7	7	2	2	2	1	2	1	34	133	220
6	Lakshitha	9	2	Virugambakkam	Vel	999	2	999	7	2	2	2	2	2	1	29	124	150
7	Shruti	9	2	Vadapalani	Vel	10	5	12	7	2	2	2	2	2	1	30	130	150
8	Darshini	9	2	Ramapuram	Vel	999	3	999	7	2	2	2	2	2	2	35	141	270
9	Manju Shree	9	2	KK Nagar	Vel	8	3	12	7	2	2	2	2	1	1	24	120	120
10	Dhanushya	9	2	KK Nagar	Vel	999	4	999	3	2	2	2	2	2	2	20	131	180
11	Mohd Asif	9	1	Vadapalani	Vel	999	5	999	7	1	2	2	2	2	2	30	130	180
12	Kevin	9	1	Nesapakkam	Vel	15	1	999	7	2	2	2	2	2	1	33	137	220
13	Sharvesh	8	1	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	22	128	180
14	Harini	9	2	Vadapalani	Vel	999	2	999	3	2	2	2	2	2	2	19	119	140
15	Yasaswini	10	2	Valasaravakkam	Vel	10	5	10	7	2	2	2	2	2	2	22	129	180
16	Keerthana	9	2	Vadapalani	Vel	13	3	10	7	2	2	2	2	2	1	21	126	150
17	Tejas	9	1	Jafferkhanpet	Vel	13	2	13	3	2	2	2	2	1	1	25	125	170
18	Nithish	9	1	Vadapalani	Vel	999	4	999	4	2	2	2	2	2	2	45	140	300
19	Sarvesh	9	1		Vel	999	999	999	7	2	2	2	2	2	1	33	128	180
20	Joel	9	1	Saidapet	Vel	10	2	12	3	2	2	2	2	2	1	24	125	210
21	Chandru	9	2		Vel	12	5	13	3	2	2	2	2	2	1	22	120	170
22	Tejashree	9	2		Vel	999	3	8	5	2	2	2	2	2	1	20	123	160
23	Mano Ranjith	9	1	Nesapakkam	Vel	10	4	10	7	2	2	2	2	2	1	36	131	230
24	Divya	9	2	KK Nagar	Vel	10	5	999	7	2	2	2	2	2	2	19	133	160
25	Shafiya Parviz	9	2	Ashok Nagar	Vel	10	999	10	7	2	2	2	2	2	2	20	126	150
26	Solomon	10	1	Ekkatuthangal	Vel	6	5	5	7	2	2	2	2	1	1	35	127	180
27	Sai Sanjay	10	1	KK Nagar	Vel	999	5	999	7	1	2	2	2	2	1	45	141	210
28	Dhanush	10	1	Ekkatuthangal	Vel	12	3	13	7	2	2	2	1	2	1	26	133	180
29	Padma ponjar	10	1	Ashok Nagar	Vel	10	5	10	3	2	1	2	2	2	2	22	120	160
30	Lithish	10	1	KK Nagar	Vel	999	5	999	5	2	2	2	2	2	2	34	128	200
31	Nather Nisha	9	2	Ashok Nagar	Vel	999	4	999	7	2	2	2	2	2	1	21	120	150
32	Priyadharshini	9	2	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	20	123	200
33	Lohitha	9	2	MGR Nagar	Vel	999	2	999	7	2	2	2	2	2	1	25	132	250
34	Sadashree	9	2	MGR Nagar	Vel	15	1	999	7	2	2	2	2	2	1	29	132	230
35	Reshmitha	9	2	Ashok Nagar	Vel	999	999	999	999	2	2	2	2	2	1	24	126	250
36	Mithun Krishna	9	1	Ashok Nagar	Vel	999	999	999	7	2	2	2	2	2	1	30	129	200
37	Seenu Vishal	9	1	Ashok Nagar	Vel	999	999	999	7	2	2	2	2	2	2	30	130	300
38	Rahul Kumar	9	1	Vadapalani	Vel	999	999	999	999	2	2	2	2	2	1	39	129	250
39	Rohit	8	1	Vadapalani	Vel	999	5	13	1	2	2	2	2	2	2	25	125	150
40	Mano Ranjan	9	1	MGR Nagar	Vel	999	4	999	7	2	2	2	2	1	1	31	131	210
41	Sadik Basha	9	1	MGR Nagar	Vel	10	5	10	7	1	2	2	2	2	1	30	130	200
42	Nishanth	9	1	KK Nagar	Vel	14	3	8	7	2	2	2	2	2	2	20	119	180

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
43	Syed Abdul	9	1	KK Nagar	Vel	999	4	999	7	2	2	2	2	2	1	25	132	220
44	Monish	10	1	Ashok Nagar	Vel	12	5	1	7	2	2	2	2	2	1	30	124	200
45	Kavin Kumar	10	1	Vadapalani	Vel	999	5	999	5	2	2	2	2	1	1	25	130	150
46	Jaya selvam	10	1	MGR Nagar	Vel	8	5	6	7	2	2	2	1	2	1	29	137	220
47	Ryan Fernando	10	1	West Mambalam	Vel	999	5	999	999	2	2	2	2	2	2	40	142	220
48	Praveen Kumar	10	1	KK Nagar	Vel	999	1	999	7	2	2	2	2	2	1	28	135	250
49	Mohan Raj	10	1	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	1	25	124	250
50	Joseph Daniel	10	1	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	1	34	144	250
51	Isaac Joel	9	1	KK Nagar	Vel	15	1	15	1	2	2	2	2	2	2	28	131	200
52	Dharshan	10	1	KK Nagar	Vel	13	5	10	7	2	2	2	2	2	1	35	141	150
53	Clinton	10	1	Nesapakkam	Vel	9	5	14	7	2	2	2	2	2	1	68	153	160
54	Aswin	10	1	MGR Nagar	Vel	5	4	8	7	2	2	2	2	2	2	24	130	250
55	Jaswant	10	1	KK Nagar	Vel	999	2	999	2	2	2	2	2	2	2	27	127	150
56	Nanda Kishore	8	1	Ramapuram	Vel	999	999	999	999	2	2	2	2	2	2	20	120	150
57	Kaushik	8	1	KK Nagar	Vel	999	3	15	1	2	2	2	2	2	2	21	124	200
58	Eliot	9	1	Pallikaranai	Vel	999	3	999	7	2	2	2	2	2	1	43	143	250
59	Dhanalakshmi	9	2	KK Nagar	Vel	999	999	999	7	2	2	2	2	2	2	20	127	200
60	Yuvanesh	9	1	Saidapet	Vel	999	4	999	7	2	2	2	2	1	2	30	134	200
61	Vasantha Kumar	9	1	MGR Nagar	Vel	999	5	999	7	2	2	2	2	2	1	32	141	230
62	Suriya	9	1	Vijayarajapuram	Vel	999	999	999	999	2	2	2	2	2	1	35	136	250
63	Shyam Kumar	9	1	MGR Nagar	Vel	999	999	999	999	2	2	2	2	2	2	23	123	220
64	Mohammed Ashraf	9	1	MGR Nagar	Vel	999	5	999	7	2	2	2	2	2	2	29	133	250
65	Giridharan	9	1	West Mambalam	Vel	999	5	999	999	2	2	2	2	2	1	25	132	250
66	Ashaq Ahamed	9	1	KK Nagar	Vel	15	1	999	999	2	2	2	2	2	1	30	138	300
67	Bhavan Raj	9	1	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	24	127	260
68	Vishnu Priya	10	2	KK Nagar	Vel	999	999	999	999	1	2	2	2	2	2	32	137	150
69	Shalini	10	2	KK Nagar	Vel	999	999	999	999	2	2	2	2	2	2	30	136	220
70	Jalasta	9	2	Guindy	Vel	999	5	999	7	2	2	2	2	2	2	50	143	200
71	Anushya Princy	10	2	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	33	136	200
72	Aishwarya	10	2	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	2	35	144	180
73	Vishal	10	1	Ashok Nagar	Vel	15	1	999	7	1	2	2	2	2	1	34	135	230
74	Surya	10	1	Ashok Nagar	Vel	13	4	13	7	2	2	2	2	2	1	22	132	300
75	Sanjay	9	1	Saidapet	Vel	999	4	999	7	2	2	2	2	2	1	25	131	250
76	Jessica	10	2	KK Nagar	Vel	999	5	999	999	2	2	2	2	2	2	37	145	200
77	Roshini	9	2	West Mambalam	Vel	999	2	999	7	2	2	2	2	2	2	35	138	200
78	Karthika Selvi	10	2	Arumbakkam	Vel	999	5	999	7	2	2	2	2	2	1	40	138	180
79	Yogesh	10	1	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	1	41	141	280
80	Suresh	10	1	MGR Nagar	Vel	999	4	999	7	2	2	2	2	2	1	24	126	180
81	Robin Savio	10	1	Valasaravakkam	Vel	15	1	15	1	2	2	2	2	2	2	26	133	200
82	Melvin	10	1	Ashok Nagar	Vel	999	4	999	3	2	2	2	2	2	2	27	135	180
83	Aishwarya	9	2	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	2	26	134	200
84	Zaara Farhana	9	2	Ashok Nagar	Vel	999	2	999	7	2	2	2	2	2	1	32	132	180
85	Sanjana	9	2	Kamarajar Salai	Vel	999	5	999	7	2	2	2	2	2	1	26	121	250

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
86	Kruthika	9	2	MGR Nagar	Vel	999	3	999	7	2	2	2	2	2	1	26	128	220
87	Harini	9	2	Ekkatuthangal	Vel	12	5	12	7	2	2	2	2	2	1	26	129	180
88	Akshaya	9	2	KK Nagar	Vel	15	5	12	7	2	2	2	2	2	1	30	124	170
89	Harish Kumar	9	1	KK Nagar	Vel	13	3	13	3	2	2	1	2	2	1	25	130	200
90	Deepak	9	1	Saligramam	Vel	10	5	13	5	2	2	2	2	2	1	25	124	160
91	Sharmatha	10	2	MGR Nagar	Vel	15	1	13	7	2	2	2	2	2	1	30	131	160
92	Nishitha	10	2	MGR Nagar	Vel	999	5	10	7	2	2	2	2	2	1	22	124	180
93	Harini	10	2	Nesapakkam	Vel	5	5	12	7	2	2	2	2	2	2	30	130	180
94	Shyam	9	1	Jafferkhanpet	Vel	10	5	10	7	2	2	2	2	2	2	32	136	200
95	Annie Joshika	10	2	Porur	Vel	999	2	15	1	2	2	2	1	2	1	39	142	240
96	Kowsalya	10	2	MGR Nagar	Vel	12	5	4	7	2	2	2	2	2	1	40	138	180
97	Aloy Gabriel	9	1	West Mambalam	Vel	999	5	999	7	2	2	2	2	2	1	40	140	230
98	Vignesh	9	1	Ekkatuthangal	Vel	13	5	12	7	2	2	2	2	2	2	38	140	250
99	Tamilarasan	9	1	Ashok Nagar	Vel	10	5	10	7	2	2	2	2	2	1	25	133	180
100	Tezus	9	1	KK Nagar	Vel	13	3	999	7	2	2	2	2	2	2	30	134	240
101	Jayavarshini	9	2	MGR Nagar	Vel	999	2	999	7	2	2	2	2	2	1	37	137	250
102	Dharani	9	2	Vadapalani	Vel	999	999	999	999	2	2	2	2	2	1	20	125	210
103	Vetrivel	10	1	MGR Nagar	Vel	999	5	999	7	2	2	2	2	2	2	21	124	200
104	Surdeep Kannan	9	1	KK Nagar	Vel	999	1	999	7	2	2	2	2	2	1	30	132	180
105	Dev Anand	9	1	MGR Nagar	Vel	999	5	999	999	2	2	2	2	2	1	25	130	240
106	Vijaya lakshmi	9	2	KK Nagar	Vel	999	5	999	7	2	2	1	2	2	2	33	127	200
107	Steffi	10	2	MGR Nagar	Vel	999	5	999	7	2	2	2	2	2	1	31	138	250
108	Santhana Lakshmi	9	2	Vadapalani	Vel	999	1	999	7	2	2	2	2	2	1	23	129	260
109	Pradheepa	9	2	Jafferkhanpet	Vel	12	5	12	7	2	2	2	2	2	2	23	122	150
110	Kalaiarasi	11	2	Jafferkhanpet	Vel	999	4	999	7	2	2	2	2	2	1	30	129	150
111	Harini	9	2	Nesapakkam	Vel	15	1	999	7	2	2	2	2	2	2	24	125	200
112	Guhan	9	1	KK Nagar	Vel	13	3	999	7	2	2	2	2	2	2	32	134	250
113	Bryan Immanuel Richard	9	1	Jafferkhanpet	Vel	15	1	15	1	2	2	2	2	2	1	28	132	160
114	Meethra Sri	9	2	Vadapalani	Vel	12	5	13	7	2	2	2	2	2	1	20	115	150
115	Rekha	9	2	MGR Nagar	Vel	12	5	12	7	2	2	2	2	2	1	40	134	170
116	Sandhoshivani	9	2	KK Nagar	Vel	13	5	14	3	2	2	2	2	2	1	25	124	170
117	Supriya	9	2	MGR Nagar	Vel	999	3	13	7	2	2	2	2	2	2	31	128	150
118	Yashwini	9	2	MGR Nagar	Vel	999	5	12	7	2	2	2	2	2	1	25	122	160
119	Hariharan	9	1	MGR Nagar	Vel	4	5	12	7	2	1	2	1	2	2	21	127	240
120	Gokul Raj	10	1	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	2	30	131	160
121	Krishna Priya	9	2	Ashok Nagar	Vel	13	3	13	3	2	2	2	2	2	2	33	133	160
122	Vishnu Vardhini	9	2	Ashok Nagar	Vel	0	7	12	7	2	2	2	2	1	1	33	137	240
123	Manothra Shree	9	2	Saligramam	Vel	9	3	13	7	2	2	2	2	2	2	19	121	160
124	Yoga Poojitha	9	2	KK Nagar	Vel	12	4	12	7	2	2	2	2	2	2	30	133	200
125	Yogeshwari	9	2	KK Nagar	Vel	999	4	999	7	2	2	2	2	2	2	30	127	150
126	Varshini	9	2	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	2	48	137	180
127	Sandhiya	9	2	Ramapuram	Vel	999	999	999	999	2	2	2	2	2	2	36	136	180
128	Rithu Priya	9	2	Jafferkhanpet	Vel	999	999	999	999	2	2	2	2	2	2	31	125	200

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
129	Keerthiga	8	2	MGR Nagar	Vel	999	5	999	7	2	2	2	2	1	2	19	121	180
130	Anbarasi	8	2	Ashok Nagar	Vel	11	4	12	7	2	2	2	2	2	1	37	128	180
131	Vishal	9	1	KK Nagar	Vel	999	3	999	7	1	2	2	2	2	2	32	136	150
132	Sharukh	9	1	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	2	20	118	140
133	Nithin	10	1	Jafferkhanpet	Vel	999	5	999	7	2	2	2	2	2	1	40	134	200
134	Karthik	9	1	KK Nagar	Vel	999	999	999	999	2	2	2	2	2	1	22	123	120
135	Joel	10	1	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	30	133	180
136	Hari haran	10	1	Virugambakkam	Vel	999	5	999	7	2	2	2	2	2	2	30	128	210
137	Bharath Raj	9	1	Kodambakkam	Vel	999	3	999	7	2	2	2	2	2	2	48	136	200
137	Lydia	9	2	Kannigapuram	Vel	15	1	999	7	2	2	2	2	2	2	23	126	180
138	Rupa	9	2	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	1	20	124	200
139	Akshaya	9	2	Saligramam	Vel	999	3	999	7	2	2	2	2	2	2	25	124	190
140	Farzana Afreed	8	2	Ashok Nagar	Vel	999	5	999	999	2	2	2	2	2	2	40	128	180
141	Bhakya lakshmi	9	2	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	2	25	124	170
142	Aishwarya	9	2	KK Nagar	Vel	13	3	15	7	2	2	2	2	2	1	36	125	200
143	Tharun Raj	9	1	West Mambalam	Vel	999	999	999	7	2	2	2	2	2	1	24	125	180
144	Mohammed Faaid	9	1	Saligramam	Vel	10	5	6	7	2	2	2	2	2	2	26	128	160
145	Justin	9	1	Jafferkhanpet	Vel	13	5	10	7	2	2	2	2	2	2	30	134	220
146	Hemanth	9	1	MGR Nagar	Vel	5	4	999	7	2	2	2	2	2	2	20	123	160
147	Yubin	9	1	MGR Nagar	Vel	999	5	999	7	2	2	2	2	2	1	27	128	180
148	Sudharsan	9	1	Jafferkhanpet	Vel	999	5	999	7	2	2	2	2	2	2	20	118	200
149	Rajakkilan	8	1	Jafferkhanpet	Vel	999	5	999	7	2	2	2	2	2	2	25	134	250
150	Kishore	9	1	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	27	129	250
151	John Wesley	9	1	Ashok Nagar	Vel	999	2	999	7	2	2	2	2	2	1	20	121	200
152	Karthikeyan	9	1	Ramapuram	Vel	999	3	999	7	2	2	2	2	2	2	38	135	180
153	Jasna Hameeda	9	2	KK Nagar	Vel	999	4	999	7	2	2	2	2	2	1	24	128	150
154	Miraculin	9	2	MGR Nagar	Vel	999	999	999	999	2	2	2	2	2	2	28	132	200
155	Vaishnavi Devi	9	2	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	2	30	129	200
156	Sujitha	9	2	Vadapalani	Vel	13	5	13	7	2	2	2	2	2	2	21	125	150
157	Prithvi Raj	10	1	MGR Nagar	Vel	13	5	10	3	2	2	2	2	2	1	30	140	260
158	Pravin	9	1	KK Nagar	Vel	10	5	10	7	2	2	2	2	2	1	35	136	160
159	Parthasarathy	9	1	KK Nagar	Vel	13	3	999	7	2	2	2	2	2	2	20	128	160
160	Sameera	9	2	Jafferkhanpet	Vel	7	5	10	7	2	2	2	2	2	2	40	120	140
161	Lokesh	9	1	Vadapalani	Vel	13	3	8	7	2	2	2	2	2	1	24	123	210
162	Nivashini	9	2	MGR Nagar	Vel	10	5	999	5	2	2	2	2	2	2	21	128	160
163	Hemnath	9	1	Ashok Nagar	Vel	12	5	10	7	2	2	2	2	2	1	32	126	260
164	Sai Saran	10	1	Vadapalani	Vel	10	5	999	7	2	2	2	2	1	1	21	124	160
165	Darshan	9	1	Vadapalani	Vel	999	5	999	7	2	2	2	2	2	1	36	135	170
166	Abishek	9	1	Ashok Nagar	Vel	10	5	5	7	2	2	2	2	2	1	32	127	240
167	Dharshini	9	1	MGR Nagar	Vel	15	1	999	7	2	2	2	2	2	2	22	122	150
168	Sarath Manickam	9	1	MGR Nagar	Vel	10	3	12	7	2	2	2	2	2	1	25	131	160
169	Gokul	9	1	MGR Nagar	Vel	999	5	999	7	2	2	2	2	2	1	23	123	170
170	Kandhan	9	1	West Mambalam	Vel	5	4	12	7	2	2	2	2	1	1	28	133	200

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
171	Dhanush	9	1	Ashok Nagar	Vel	10	5	12	7	2	2	2	2	2	2	20	124	160
172	Mohammed aadil	9	1	Ashok Nagar	Vel	10	4	8	7	2	2	2	2	2	2	35	135	200
173	Lydia Blessy	9	2	KK Nagar	Vel	10	4	13	3	2	2	2	2	2	2	21	122	180
174	Durgesham	9	2	Vadapalani	Vel	10	4	12	7	2	2	2	2	2	1	21	128	130
175	Shaheena	9	2	Ashok Nagar	Vel	12	5	8	7	2	2	2	2	2	2	25	124	160
176	Ramya	9	2	KK Nagar	Vel	12	5	13	7	2	2	2	2	2	2	20	123	160
177	Nivetha	9	2	MGR Nagar	Vel	10	5	10	7	2	2	2	2	2	1	25	132	260
178	Akshaya	9	2	KK Nagar	Vel	10	3	13	7	2	2	2	2	2	2	30	129	160
179	Vishal	9	1	Ekkatuthangal	Vel	13	5	999	7	2	2	2	2	2	1	35	128	160
180	Sebastian Ron	9	1	Vadapalani	Vel	999	3	999	7	2	2	2	2	2	2	30	130	200
181	Krithika	9	2	Nesapakkam	Vel	5	4	10	7	1	2	2	2	2	2	26	131	150
182	Varshini	9	2	Ekkatuthangal	Vel	15	1	999	7	2	2	2	2	2	1	29	128	200
183	Sharmitha	8	2	KK Nagar	Vel	999	999	999	999	2	2	2	2	2	1	22	129	150
184	Sowmya	9	2	KK Nagar	Vel	999	5	999	999	2	2	2	2	2	1	24	127	180
185	Nivetha	9	2	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	1	31	128	150
186	Nidhisha	9	2	Vadapalani	Vel	999	4	999	3	1	2	2	2	1	1	41	133	180
187	Manisha	9	2	MGR Nagar	Vel	999	5	999	7	2	2	2	2	2	2	24	130	180
188	Kiruba	9	2	Vadapalani	Vel	15	1	999	7	2	2	2	2	2	1	30	132	150
189	Divyanka	9	2	Virugambakkam	Vel	999	5	999	7	2	2	2	2	2	2	35	129	160
190	Hemavarshini	9	2	KK Nagar	Vel	999	4	999	3	1	2	2	2	2	1	25	125	160
191	Bala dharshini	9	2	ayyapanthangal	Vel	999	5	999	3	2	2	2	1	2	2	25	127	190
192	Thirumalai	10	1	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	27	130	200
193	Rikesh Raj	9	1	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	43	142	350
194	Ranjith Kumar	9	1	MGR Nagar	Vel	999	4	999	7	2	2	2	2	2	2	38	137	130
195	Prajai	9	1	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	1	39	132	200
196	Madhesh	9	1	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	25	128	280
197	Krishna Kumar	8	1	Jafferkhanpet	Vel	999	5	999	7	2	2	2	2	2	1	30	134	230
198	Avinash	8	1	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	1	31	136	180
199	Krithik Prasad	9	1	KK Nagar	Vel	999	3	999	7	2	2	2	2	2	1	20	126	230
200	Sharon King	9	2	Ashok Nagar	Vel	15	1	999	7	2	2	2	2	2	1	29	129	230
201	Rishikesh	9	1	MGR Nagar	Vel	8	5	13	7	2	2	2	2	2	1	25	132	220
202	Pravin Kumar	8	1	MGR Nagar	Vel	999	4	999	3	2	2	2	2	2	2	25	125	240
203	Monishwaran	9	1	Ashok Nagar	Vel	999	3	999	7	2	2	2	2	2	1	24	126	200
204	Kevin	9	1	KK Nagar	Vel	13	3	13	3	2	2	2	2	1	1	21	125	170
205	Gowri Shankar	10	1	Nesapakkam	Vel	999	4	999	7	1	2	2	2	2	2	33	134	200
206	Abdul Khader	10	1	MGR Nagar	Vel	999	3	999	7	2	2	2	2	1	1	32	131	190
207	Shakthi Priya	9	2	MGR Nagar	Vel	999	5	999	7	2	2	2	2	2	2	25	123	180
208	Priya shri	9	2	Guindy	Vel	999	4	999	7	2	2	2	2	2	2	19	117	180
209	Nethra	9	2	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	1	20	132	180
210	Kavisha	9	2	Nesapakkam	Vel	999	3	999	7	2	2	2	2	2	1	25	126	230
211	Harini Suresh	9	2	Ashok Nagar	Vel	999	3	999	7	2	2	2	2	2	1	22	133	180
212	Poornima	9	2	Vadapalani	Vel	999	4	999	7	2	2	2	2	1	2	17	119	150
213	Nafila	9	2	Ashok Nagar	Vel	999	5	999	5	2	2	2	2	2	1	19	117	120

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
214	Hemalatha	9	2	KK Nagar	Vel	999	4	999	4	2	2	2	2	2	2	17	117	170
215	Vigneshwari	8	1	Vadapalani	Vel	999	3	999	7	2	2	2	2	2	1	30	137	200
216	Santhosh Kumar	8	1	Ramapuram	Vel	999	3	999	7	2	2	2	2	1	2	25	119	250
217	Mugesh Kumar	9	1	Jafferkhanpet	Vel	999	5	999	5	2	2	2	1	2	1	35	134	200
218	Jayasurya	9	1	Ramapuram	Vel	999	5	999	7	2	2	2	2	2	2	24	126	160
219	Gokul Mani	9	1	Vijayarajapuram	Vel	999	5	999	7	2	2	2	2	2	2	26	127	150
220	Lokesh Raj	9	1	Ashok Nagar	Vel	999	4	999	7	2	2	2	2	2	1	26	126	200
221	Dheeraj Nath	9	1	KK Nagar	Vel	999	3	999	7	2	2	2	2	2	2	35	134	350
222	Abinaya	9	2	Vijayarajapuram	Vel	999	5	999	7	2	2	2	2	2	1	21	126	220
223	Ashwanth Xavier	8	1	KK Nagar	Vel	10	4	9	7	1	2	2	2	2	1	22	126	220
224	Dhivakar	9	1	Ekkatuthangal	Vel	999	999	999	7	2	2	2	2	2	1	36	130	230
225	Habeebul Basha	9	1	MGR Nagar	Vel	13	3	10	7	2	2	2	2	2	1	48	137	250
226	Karkiche	9	1	MGR Nagar	Vel	14	5	13	3	2	2	2	2	2	2	30	139	220
227	Manoj	10	1	KK Nagar	Vel	999	2	999	7	2	2	1	2	2	1	30	129	220
228	Prabhat	10	1	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	1	32	130	220
229	Sanjay	9	1	Vadapalani	Vel	999	5	999	7	2	2	2	2	2	1	30	133	190
230	Siva Harish	10	1	Ekkatuthangal	Vel	12	5	999	7	2	2	2	2	2	1	28	128	200
231	Jennifer	13	2	Ramapuram	SJS	13	5	14	7	1	2	2	2	2	2	71	160	150
232	Harini	13	2	Nerkundram	SJS	12	2	10	7	2	1	1	1	2	1	38	151	240
233	Gopika	14	2	Virugambakkam	SJS	13	5	13	7	2	2	2	2	2	1	45	145	150
234	Amreen Banu	13	2	AT Nagar	SJS	12	5	10	7	2	2	2	2	2	1	50	157	260
235	Vikas	14	1	Mettukuppam	SJS	999	5	999	7	2	2	2	2	2	1	37	160	320
236	Sudhakar Rao	15	1	Virugambakkam	SJS	10	4	10	5	2	2	2	2	2	1	57	163	220
237	Sai Prasanna	14	1	Valasaravakkam	SJS	10	5	15	3	2	1	2	2	2	1	49	173	360
238	Rajesh	14	1	AT Nagar	SJS	10	5	5	7	2	2	2	2	2	1	56	164	380
239	Mukesh	14	1	Valasaravakkam	SJS	13	5	13	7	2	2	2	2	2	1	52	167	360
240	Kamalesh Kumar	14	1	Mettukuppam	SJS	5	5	999	7	2	2	2	2	2	1	65	165	430
241	John Sam	14	1	Anbu Nagar	SJS	15	5	13	7	2	2	2	2	2	2	44	157	350
242	Harish	13	1	AT Nagar	SJS	12	5	12	7	2	2	2	2	2	1	60	170	340
243	Hanuman	15	1	AT Nagar	SJS	7	5	0	7	2	2	2	2	2	1	49	158	460
244	Divakar	14	1	Nesapakkam	SJS	6	4	12	7	1	2	1	2	2	1	60	175	420
245	Devi Louis	14	1	Valasaravakkam	SJS	13	5	10	7	2	2	2	2	1	2	48	153	320
246	Hari Priyan	10	1	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	1	45	139	300
247	Padmaja	10	2	KK Nagar	Vel	999	5	13	7	2	2	2	2	2	2	29	130	150
248	Jobritt Revitha	10	2	KK Nagar	Vel	14	5	15	7	1	2	2	2	2	2	29	135	180
249	Jagatha	10	2	Virugambakkam	Vel	10	5	12	7	2	2	2	2	2	1	45	135	260
250	Sridhar	10	1	KK Nagar	Vel	999	4	999	7	2	2	2	2	2	2	24	131	210
251	Sasi Praveen	11	1	MGR Nagar	Vel	999	3	999	7	2	2	2	2	2	2	22	122	200
252	Gunti Naveen	11	1	KK Nagar	Vel	999	3	999	7	1	1	2	2	1	1	41	143	260
253	Andrew Silvin	10	1	MGR Nagar	Vel	13	5	0	7	2	2	2	2	1	1	54	140	240
254	Gowtham	10	1	KK Nagar	Vel	10	4	13	7	2	2	2	2	2	1	57	145	260
255	Fayesha Banu	9	2	KK Nagar	Vel	13	5	13	7	2	2	2	2	2	1	30	136	200
256	Syed Sharifa	10	2	KK Nagar	Vel	13	3	13	3	2	2	2	2	2	2	31	133	260

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
257	Gayathri	10	2	KK Nagar	Vel	999	4	999	4	2	1	2	2	2	1	48	146	300
258	Akshitha	10	2	Ramapuram	Vel	9	3	13	7	2	2	2	2	2	2	35	144	180
259	Belcia Inbavalar	10	2	KK Nagar	Vel	999	5	999	7	2	2	2	1	2	1	40	145	300
260	Mahalakshmi	11	2	MGR Nagar	Vel	8	5	12	7	1	2	2	1	2	2	26	136	150
261	Yogeshwar	10	1	Saidapet	Vel	999	4	999	7	2	2	1	2	2	1	35	133	200
262	Vishwa	10	1	Ekkatuthangal	Vel	999	5	999	7	2	2	2	2	2	2	35	135	260
263	Tilak	10	1	Saligramam	Vel	999	5	999	7	2	2	2	2	2	1	30	137	230
264	Sreenath	10	1	Ramapuram	Vel	6	5	10	5	2	2	2	2	2	1	25	138	210
265	Siva . M.	10	1	Vadapalani	Vel	999	5	999	3	2	2	2	2	2	2	31	132	250
266	Nishanth T	10	1	MGR Nagar	Vel	15	5	15	7	2	2	2	2	2	1	35	139	250
267	Sai Prasad	10	1	KK Nagar	Vel	14	2	999	7	2	2	2	2	2	1	28	137	250
268	Bala Ganesan	10	1	Saidapet	Vel	999	3	13	3	2	2	2	2	2	2	32	128	180
269	Melvin Rivoldo	10	1	MGR Nagar	Vel	999	2	999	7	2	2	2	2	2	1	27	130	250
270	Jaffer Ali	10	1	Vadapalani	Vel	999	4	10	7	2	2	2	2	2	1	31	138	200
271	Harish	10	1	West Mambalam	Vel	999	2	999	7	2	2	2	2	2	1	33	134	250
272	Jeevanandham	10	1	KK Nagar	Vel	999	4	999	7	2	2	2	2	2	1	33	142	300
273	Diwakar	10	1	MGR Nagar	Vel	999	4	10	7	2	2	2	2	2	1	30	130	250
274	Asha J	10	2	Virugambakkam	Vel	999	5	999	7	2	2	2	2	2	2	32	141	200
275	Karthick	10	1	Nesapakkam	Vel	999	5	999	7	2	2	2	2	2	2	33	141	180
276	Janani P	10	2	Jafferkhanpet	Vel	999	4	10	7	2	2	2	2	2	2	31	135	210
277	Meruthula	10	2	KK Nagar	Vel	999	3	999	3	2	2	2	2	2	1	40	134	200
278	Varsha Matthew	10	2	Ashok Nagar	Vel	10	4	13	3	1	2	2	2	2	1	29	141	140
279	Nisha Varshini	10	2	MGR Nagar	Vel	15	1	999	7	1	2	2	1	2	2	37	132	200
280	Sadhvi	9	2	Ashok Nagar	Vel	14	3	999	7	2	2	2	2	2	1	30	134	200
281	Parithy	10	1	Ashok Nagar	Vel	999	3	999	7	2	2	2	2	2	2	30	141	250
282	Kaviya Varshini	10	2	Ashok Nagar	Vel	999	4	999	7	1	2	2	2	2	1	35	134	200
283	Catherine Sweety	10	2	Ashok Nagar	Vel	999	4	13	3	2	2	2	2	2	1	30	124	150
284	Vishali	10	2	KK Nagar	Vel	12	5	12	7	2	2	2	2	2	1	40	140	160
285	Vaishnavi	10	2	Saligramam	Vel	13	5	12	7	2	2	2	2	2	1	26	134	200
286	Subashree	11	2	Vadapalani	Vel	12	5	12	7	2	2	2	2	1	2	28	134	260
287	Swetha	10	2	West Mambalam	Vel	9	5	12	7	2	2	2	2	1	1	28	133	200
288	Subashini	10	2	KK Nagar	Vel	14	3	13	3	2	2	2	2	2	1	34	133	220
289	Preethi	10	2	Ashok Nagar	Vel	7	3	12	7	2	2	2	2	2	1	40	133	200
290	Pavithra	11	2	KK Nagar	Vel	12	2	13	3	2	2	2	2	2	2	33	135	210
291	Narmadhasri	10	2	Saligramam	Vel	10	3	13	7	1	2	2	2	2	1	30	136	210
292	Lakshmi Priya	10	2	Ashok Nagar	Vel	12	5	12	7	2	2	2	2	2	2	33	134	180
293	Jeevika	10	2	KK Nagar	Vel	13	3	13	3	2	2	2	2	2	1	45	135	220
294	Jennifer Theresa	10	2	Vadapalani	Vel	10	5	10	5	2	2	2	2	2	2	35	135	200
295	Anushiya	10	2	Ashok Nagar	Vel	6	4	6	7	2	2	2	2	2	2	28	136	180
296	Husnara	10	2	KK Nagar	Vel	13	3	12	7	2	2	2	2	1	2	35	145	220
297	Aishwarya	10	2	KK Nagar	Vel	13	3	13	3	2	1	1	2	2	2	35	138	160
298	Dharani	10	2	MGR Nagar	Vel	12	5	10	7	2	2	2	2	2	1	42	143	210
299	Yunus Khan	10	1	Vadapalani	Vel	10	5	9	7	2	2	2	2	1	1	29	139	300

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
300	Lokesh	11	1	Jafferkhanpet	Vel	15	1	999	7	2	2	2	2	2	2	27	138	250
301	Karthik	11	1	KK Nagar	Vel	999	0	999	7	2	2	2	2	2	2	25	135	230
302	Guru Prasath	11	1	Jafferkhanpet	Vel	5	5	13	7	2	2	1	2	1	1	45	138	250
303	Gouthaman	10	1	KK Nagar	Vel	999	999	999	999	2	2	2	2	2	1	28	133	200
304	Dhinakaran	10	1	Guindy	Vel	999	3	12	7	2	1	2	2	2	2	25	126	190
305	Ashwin	11	1	Ekkatuthangal	Vel	999	5	999	7	2	1	2	2	2	1	20	125	180
306	Abinithin	10	1	KK Nagar	Vel	999	4	999	3	2	2	2	2	2	2	30	142	250
307	Nithish	10	1	KK Nagar	Vel	999	5	999	7	2	2	2	2	2	2	30	137	260
308	Manoj	10	1	KK Nagar	Vel	5	4	13	3	1	2	2	2	2	2	34	137	220
309	Surya Akash	10	1	Ashok Nagar	Vel	10	4	999	7	2	2	2	2	2	1	24	126	210
310	Dharun Kannan	10	1	Ekkatuthangal	Vel	999	999	999	999	2	2	2	2	2	2	25	125	120
311	Pranav	9	1	Vadapalani	Vel	15	1	999	7	2	2	2	2	2	1	45	137	260
312	Mohammed Tarooq	10	1	Ashok Nagar	Vel	13	2	13	7	2	2	2	2	1	1	37	137	220
313	Sadhana Priya	10	2	KK Nagar	Vel	13	5	13	7	1	2	2	2	2	1	23	132	180
314	Blessing Joshua	10	1	Nesapakkam	Vel	10	5	13	7	2	2	2	1	2	1	27	130	200
315	Crispin	9	1	Nesapakkam	Vel	15	1	999	7	2	1	2	2	2	1	30	140	190
316	Harish	10	1	Vadapalani	Vel	10	5	8	7	2	2	2	2	1	1	25	135	220
317	Jeffrey	10	1	Kilpauk	Vel	999	2	999	7	2	2	2	2	2	1	24	126	250
318	Kamaleshan	11	1	Kodambakkam	Vel	10	4	13	3	1	2	2	2	2	2	35	144	160
319	Kavin Ganeshan	10	1	MGR Nagar	Vel	999	3	999	7	2	2	2	2	1	1	34	132	280
320	Khalith	10	1	Saligramam	Vel	999	4	999	7	2	2	2	2	2	2	42	144	240
321	Durai Rajan	10	1	Saidapet	Vel	13	2	13	3	2	2	2	2	2	2	30	134	260
322	Subasree	10	2	Saidapet	Vel	12	5	12	7	2	2	2	2	2	2	24	134	180
323	Sowmithra	10	2	KK Nagar	Vel	10	4	13	3	2	2	2	2	2	2	38	139	180
324	Safiya Banu	10	2	KK Nagar	Vel	15	1	12	7	2	2	2	2	2	2	30	136	100
325	Pretha	10	2	KK Nagar	Vel	10	4	9	7	2	2	2	1	2	2	21	132	180
326	Janani	10	2	KK Nagar	Vel	999	4	999	3	2	2	2	2	2	2	25	128	150
327	Mrinal Dev	10	1	Ashok Nagar	Vel	15	1	999	7	2	2	2	2	2	1	29	138	280
328	Indhuja	10	2	KK Nagar	Vel	13	5	13	7	2	2	2	2	2	2	20	124	100
329	Harini	10	2	Jafferkhanpet	Vel	999	2	13	3	2	2	2	2	2	2	24	138	150
330	Athulya	10	1	MGR Nagar	Vel	999	3	999	7	2	2	2	2	2	2	31	140	220
331	Pavithran	10	1	Ashok Nagar	Vel	999	2	10	7	2	2	2	2	2	2	24	132	200
332	Vinoth	10	1	Ashok Nagar	Vel	999	5	999	7	2	2	2	2	2	2	53	151	260
333	Sarath Kumar	10	1	Ashok Nagar	Vel	999	2	999	7	2	2	2	2	1	1	30	136	250
334	Nithish	10	1	MGR Nagar	Vel	999	5	999	7	2	2	2	2	2	2	28	129	180
335	Naveen	10	1	Jafferkhanpet	Vel	999	5	999	3	2	2	2	2	2	2	26	134	200
336	Suhail Ahmed	10	1	Vadapalani	Vel	13	4	5	7	2	2	2	2	2	1	41	141	260
337	Jessica	11	2	KK Nagar	Vel	999	999	999	999	2	2	2	2	2	2	29	135	210
338	Shifa	10	2	KK Nagar	Vel	13	4	13	7	2	2	2	2	2	1	42	154	260
339	Benny	13	1	Indira Nagar	SJS	999	4	999	7	2	2	2	2	2	2	49	175	360
340	Azeem Khan	13	1	AT Nagar	SJS	13	4	10	7	2	2	2	2	2	2	48	155	300
341	Ashwin	14	1	AT Nagar	SJS	15	1	999	7	2	2	2	2	2	1	44	165	160
342	Thrisan	14	1	Ramapuram	SJS	10	0	11	7	2	2	1	2	2	1	50	164	420

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
343	Yudhasini	14	2	Mettukuppam	SJS	15	1	13	7	2	2	2	2	2	2	45	158	240
344	Nandhini	14	2	AT Nagar	SJS	999	5	10	7	2	2	2	2	2	2	52	150	200
345	Magesh	14	1	Ramapuram	SJS	12	5	12	7	2	2	2	2	2	1	31	142	320
346	Dilip Kumar	13	1	Rukmani Nagar	SJS	10	5	12	3	2	2	2	2	2	2	62	158	400
347	Keerthana	13	2	Nesapakkam	SJS	10	2	12	7	2	2	2	2	2	2	75	157	130
348	Nandhini	13	2	Saligramam	SJS	13	3	12	7	2	2	2	2	1	2	40	148	150
349	Sherryn	13	2	Valasaravakkam	SJS	13	2	13	3	2	2	1	2	2	2	43	156	150
350	Akshya	13	2	Virugambakkam	SJS	13	3	13	3	2	2	2	2	2	1	51	165	250
351	Jenolin	14	2	AT Nagar	SJS	13	3	13	3	2	2	2	2	2	2	49	164	200
352	Keerthana P	14	2	AT Nagar	SJS	13	3	13	3	2	2	2	2	2	2	38	156	240
353	Lavanya	13	2	AT Nagar	SJS	12	3	13	7	2	2	2	2	2	1	42	161	200
354	Santhya	13	2	AT Nagar	SJS	12	5	12	7	2	2	2	2	2	1	42	159	200
355	Shanaaz	13	2	Dhanalakshmi Colony	SJS	13	3	999	7	2	2	2	2	2	2	40	157	210
356	Sushmitha	14	2	AT Nagar	SJS	12	5	10	5	2	2	2	2	2	1	58	156	180
357	Sanjeev	13	1	Virugambakkam	SJS	13	3	14	7	1	2	2	2	2	1	50	147	250
358	Saran	14	1	AT Nagar	SJS	15	1	999	7	2	2	2	2	2	1	45	171	340
359	Sabari Vasan	13	1	Ramapuram	SJS	15	1	12	7	2	2	2	2	2	1	46	171	250
360	Sanjay	14	1	Virugambakkam	SJS	13	3	10	7	2	2	2	1	2	2	49	165	350
361	Shadrach	13	1	Ramalinga Nagar	SJS	15	1	13	7	2	2	2	2	2	2	50	159	400
362	Nandhini	14	2	Nehru Street	SJS	7	5	10	7	2	2	2	2	2	1	40	156	300
363	Nasreen	13	2	Virugambakkam	SJS	12	5	7	7	2	2	2	1	2	1	49	163	250
364	Vikas	14	1	Virugambakkam	SJS	10	5	9	7	2	2	2	2	2	1	36	160	340
365	Vikas	14	1	AT Nagar	SJS	5	5	999	7	2	2	2	2	2	1	50	165	320
366	Mohammed Sudhaij	13	1	Virugambakkam	SJS	10	5	10	7	2	2	2	2	2	1	44	160	360
367	Manoj	14	1	Kamarajar Salai	SJS	10	5	999	7	2	2	2	2	2	1	36	157	430
368	Magesh	13	1	AT Nagar	SJS	12	5	10	7	2	2	2	2	2	1	48	173	350
369	Praveena	13	2	AT Nagar	SJS	10	3	999	3	1	2	2	2	2	1	49	163	200
370	Theybora Jansi	13	2	Virugambakkam	SJS	10	5	8	7	2	2	2	2	1	1	45	162	210
371	Sneha	13	2	Valasaravakkam	SJS	12	3	12	7	2	2	2	2	2	1	36	160	220
372	Praveen Kumar	14	1	Saligramam	SJS	10	5	8	7	2	2	2	2	2	1	36	150	290
373	Subashree	14	2	Ramapuram	SJS	999	5	12	7	2	1	2	2	2	2	59	153	300
374	Sudarshana	13	2	AT Nagar	SJS	12	5	12	7	2	2	2	2	2	1	40	153	180
375	Subashni	13	2	AT Nagar	SJS	12	2	12	7	2	2	2	2	2	2	64	168	160
376	Paul Tamil Selvan	13	1	Indira Nagar	SJS	12	5	10	7	2	2	2	2	2	2	34	154	340
377	Karthik	13	1	Gowtha Nagar	SJS	13	3	12	7	2	2	2	2	2	2	45	166	380
378	Kamalesh	13	1	Virugambakkam	SJS	12	3	12	7	2	2	2	2	2	1	35	155	210
379	Kavya	14	2	AT Nagar	SJS	999	2	999	3	2	2	1	1	2	2	50	160	200
380	Jeya Kumar	13	1	Saligramam	SJS	10	5	12	7	2	2	2	2	2	1	44	150	250
381	Harish	14	1	AT Nagar	SJS	10	4	10	7	1	2	2	2	2	1	72	163	380
382	Gopikannan	14	1	Alapakkam	SJS	13	3	14	7	2	2	2	2	1	1	55	170	420
383	Ganesh	14	1	AT Nagar	SJS	9	4	8	7	2	2	2	2	2	2	49	151	250
384	Gurram Shilpi	14	1	Nesapakkam	SJS	15	1	13	7	2	2	2	2	1	2	46	159	290

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
385	Chinnarasu	15	1	Valasaravakkam	SJS	15	1	12	7	1	2	2	2	2	1	39	155	320
386	Banumathi	14	2	AT Nagar	SJS	13	4	14	7	2	2	2	2	2	2	40	156	300
387	Abinesh	14	1	Valasaravakkam	SJS	13	1	12	7	2	2	2	2	2	2	44	168	360
388	Akila	14	2	AT Nagar	SJS	999	5	10	7	2	2	1	2	2	1	36	160	320
389	Ashok Kumar	13	1	MGR Nagar	SJS	13	5	13	7	2	2	2	2	2	2	45	155	200
390	Anish	13	1	AT Nagar	SJS	12	5	10	7	2	2	1	2	2	1	70	170	380
391	Santhya	13	2	AT Nagar	SJS	10	5	10	7	2	2	2	2	2	2	51	154	180
392	Yuvashree	14	2	Valasaravakkam	SJS	10	4	10	7	2	2	2	2	2	2	42	165	250
393	Vennila	13	2	Nerkundram	SJS	6	5	999	7	2	2	1	2	2	2	34	143	100
394	Sharmila	14	2	AT Nagar	SJS	10	4	10	7	2	2	2	2	2	2	51	155	200
395	Surma Devi	14	2	Nerkundram	SJS	9	5	999	7	1	2	2	2	2	2	51	166	250
396	Monicka	13	2	Maduravoyal	SJS	12	5	10	7	2	2	2	2	2	1	54	159	200
397	Ajay	14	1	Valasaravakkam	SJS	999	0	14	3	2	2	2	2	2	1	50	171	430
398	Parthasarathy	14	1	Maduravoyal	SJS	6	4	12	3	1	2	2	2	2	2	30	149	150
399	Charan	13	1	Maduravoyal	SJS	9	4	12	7	PAST	2	2	2	2	1	54	154	320
400	Deepak Balasubramaniam	12	1	Virugambakkam	SJS	14	2	13	7	2	2	2	2	2	1	53	158	320
401	Harish K	13	1	KK Nagar	SJS	10	0	5	7	2	2	2	2	1	1	37	151	300
402	Jagan	12	1	Sri Lakshmi Nagar	SJS	8	5	9	5	1	2	2	2	1	2	28	137	220
403	Kishore Kumar	13	1	Porur	SJS	999	3	13	7	2	2	2	2	1	1	25	149	380
404	Lokesh	13	1	AT Nagar	SJS	8	4	13	3	2	2	2	2	2	2	57	171	390
405	Manikandan	13	1	Vadapalani	SJS	13	4	10	7	2	2	2	2	2	1	52	159	300
406	Muthu Ram	14	1	Virugambakkam	SJS	10	3	8	7	1	2	2	2	2	2	54	149	290
407	Netaji	13	1	Ramapuram	SJS	10	5	999	7	2	2	2	2	2	2	53	165	410
408	Pushkaran	13	1	Valasaravakkam	SJS	9	5	10	7	2	1	2	2	1	1	29	150	260
409	Rahul	12	1	Virugambakkam	SJS	13	5	11	7	2	2	2	2	2	2	33	154	240
410	Siva Prakash	12	1	Vadapalani	SJS	10	4	3	7	2	1	2	2	2	2	46	149	270
411	Afrin Fatima	12	2	Mettukuppam	SJS	10	4	5	7	2	2	2	2	2	1	56	159	160
412	Bhagavathi	12	2	AT Nagar	SJS	12	2	12	7	2	2	2	1	2	2	50	155	210
413	Blesslin Jaffy	13	2	Ramapuram	SJS	999	5	14	3	2	2	2	2	2	2	40	161	240
414	Dharshini Shree	12	2	KK Nagar	SJS	13	3	13	3	2	1	2	2	2	1	48	157	240
415	Gayathri	12	2	AT Nagar	SJS	10	4	5	4	2	2	2	1	2	1	28	146	150
416	Gayathri N	12	2	Virugambakkam	SJS	999	5	999	7	2	2	1	2	2	1	26	146	260
417	Azeena Afrose	12	2	Virugambakkam	SJS	10	5	8	7	2	2	2	2	2	2	26	149	280
418	Narmadha	12	2	Maduravoyal	SJS	9	5	9	7	2	2	2	2	2	2	27	154	260
419	Priyanka	12	2	Virugambakkam	SJS	14	5	999	3	1	2	2	2	2	2	39	151	240
420	Saravana Priya	12	2	Nesapakkam	SJS	15	1	999	7	2	2	2	2	2	2	28	148	260
421	Shakthi	13	2	AT Nagar	SJS	15	5	14	7	2	2	2	2	1	1	40	150	260
422	Varuni	13	2	Valasaravakkam	SJS	12	5	14	7	2	2	2	2	1	1	42	168	200
423	Vijayalakshmi	13	2	Valasaravakkam	SJS	999	5	999	7	2	2	2	2	2	2	30	154	290
424	Dhanvanth	14	1	AT Nagar	SJS	999	4	12	7	2	2	2	2	2	2	36	146	310
425	Kirubakaran	13	1	Kaikankuppam	SJS	14	3	13	7	2	2	2	2	2	1	46	149	360
426	Kiruba Nidhi	13	1	Mettukuppam	SJS	999	0	10	7	2	2	2	2	2	1	44	166	200

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
427	Mohammed Mohaideen	13	1	AT Nagar	SJS	13	5	12	7	2	2	2	2	2	1	40	160	250
428	Mohammed Mujahim	14	1	AT Nagar	SJS	13	5	12	7	2	2	2	2	2	1	44	162	250
429	Sakthi	13	1	Nerkundram	SJS	12	3	10	3	2	2	2	2	2	1	48	156	240
430	Shwetha	14	2	Valasaravakkam	SJS	999	5	999	7	2	2	2	2	2	1	30	150	130
431	Abdur Rehman	14	1	Valasaravakkam	SJS	999	3	999	7	2	2	2	2	2	2	65	167	375
432	Abishek	14	1	Alapakkam	SJS	15	1	14	3	2	2	2	1	2	1	72	165	360
433	Arunachalam	13	1	AT Nagar	SJS	999	4	13	3	2	2	2	2	2	1	49	163	300
434	Aravind	13	1	Ramapuram	SJS	15	5	10	7	2	2	2	2	2	1	52	162	250
435	Arun Balaji	14	1	Virugambakkam	SJS	13	5	13	7	2	2	2	2	2	2	59	155	240
436	Jayaraj	13	1	AT Nagar	SJS	10	5	12	7	2	2	1	2	2	2	36	157	260
437	Gowtham	14	1	AT Nagar	SJS	10	5	10	7	1	2	2	2	2	1	71	179	350
438	Joel	14	1	Alapakkam	SJS	14	5	13	7	2	2	2	2	1	1	50	171	200
439	Muthu Manikandan	14	1	Maduravoyal	SJS	8	5	5	7	1	2	2	2	2	2	48	163	320
440	Noel	13	1	Alapakkam	SJS	14	4	13	7	2	2	2	2	1	1	45	170	210
441	Vignesh	15	1	Virugambakkam	SJS	10	5	0	7	2	2	2	2	2	1	49	159	270
442	Naveen Karthik	14	1	Virugambakkam	SJS	13	4	13	3	2	2	2	2	2	1	46	167	250
443	Pushpam Manikandan	14	2	MGR Nagar	SJS	12	5	10	7	2	2	2	2	2	2	65	173	210
444	Aarthi	14	2	AT Nagar	SJS	12	5	10	7	2	2	2	2	2	1	39	159	180
445	Aishwarya	14	2	Virugambakkam	SJS	15	1	13	7	2	2	2	2	2	2	59	156	250
446	Crena	13	2	Virugambakkam	SJS	8	5	8	0	1	2	1	2	2	2	51	158	230
447	Sridevi	8	2	Nandambakkam	Vel	10	5	10	7	2	2	2	2	2	2	19	117	130
448	Kishalini	10	2	KK Nagar	Vel	13	2	14	7	2	2	2	2	2	1	33	131	200
449	Soniya	10	2	MGR Nagar	Vel	999	5	12	7	2	2	2	2	2	1	34	136	160
450	Preethi	10	2	KK Nagar	Vel	999	4	999	7	2	2	2	2	1	1	25	122	180
451	Muthu Madhumitha	11	2	KK Nagar	Vel	12	3	12	7	2	2	2	2	2	2	29	126	120
452	Jeffran Calvin	10	1	KK Nagar	Vel	15	1	999	7	2	2	1	2	2	2	36	131	200
453	Kaviarasan	10	1	KK Nagar	Vel	999	999	999	7	2	2	2	2	2	2	30	133	220
454	Tamilarasi	10	2	KK Nagar	Vel	10	4	7	7	2	2	2	1	2	1	29	136	200
455	Siva Sanjeev	10	1	MGR Nagar	Vel	999	4	13	3	2	1	2	2	2	2	24	131	160
456	Annamari	10	2	MGR Nagar	Vel	5	4	8	7	2	2	2	2	2	2	25	135	160
457	Cardine	10	2	MGR Nagar	Vel	6	5	12	5	2	1	2	2	2	2	28	138	170
458	Kruthika	10	2	KK Nagar	Vel	10	4	10	7	2	1	2	2	2	1	23	129	180
459	Mithiran	10	1	Vadapalani	Vel	10	4	5	7	2	2	2	2	2	2	33	134	210
460	Deepak Darshan	10	1	Vadapalani	Vel	12	4	12	7	2	2	2	2	2	1	32	137	200
461	Venkadachalam	10	1	Ekkatuthangal	Vel	14	3	999	7	2	2	2	2	2	2	34	138	230
462	Deepak	10	1	MGR Nagar	Vel	999	3	10	7	2	2	2	2	2	2	20	132	200
463	Kamalesh	10	1	Ashok Nagar	Vel	15	1	999	7	2	2	2	2	2	2	21	125	350
464	Ashish Jandyala	10	1	MGR Nagar	Vel	10	5	13	7	2	1	2	2	1	1	29	140	210
465	Jenofer	10	1	MGR Nagar	Vel	12	5	10	7	2	2	2	1	2	2	45	143	180
466	Karthikeyan	10	1	KK Nagar	Vel	999	999	999	999	2	2	2	2	2	2	27	130	220
467	Mani	10	1	KK Nagar	Vel	999	999	999	999	2	2	2	2	2	2	36	148	210
468	Thanmai	10	1	Jafferkhanpet	Vel	13	2	13	7	1	2	2	2	2	1	29	127	200
469	Pawan Aditya	10	1	KK Nagar	Vel	13	3	12	7	2	2	2	2	2	2	43	143	300

S.NO	Name	Age	Sex	Address	School	Father's literacy	Father's employment	Mother's literacy	Mother's employment	Smoking	Atopy in father	Atopy in mother	Atopy in siblings	Pets	Mosquito mats	Weight	Height	PEFR
470	Akash	10	1	KK Nagar	Vel	999	5	10	7	2	2	2	2	2	1	36	142	240
471	Dheerka Dharshan	10	1	Santhome	Vel	13	3	10	7	2	2	2	2	2	2	22	134	240
472	Moneesh	10	1	Vadapalani	Vel	13	5	999	7	2	2	2	2	2	1	20	142	220
473	Narendran	10	1	KK Nagar	Vel	8	5	12	3	2	2	2	2	2	1	35	139	210
474	Priya Dharshan	10	1	MGR Nagar	Vel	12	4	10	7	2	2	2	2	1	1	30	144	200
475	Arokkia Shiny	10	2	KK Nagar	Vel	14	5	999	7	2	2	2	2	2	1	38	150	200
476	Dhiyashri	10	2	Ekkatuthangal	Vel	13	5	13	7	2	2	2	2	2	2	30	135	180
477	Joshitha	10	2	Virugambakkam	Vel	13	2	999	7	2	2	2	2	2	2	43	150	210
478	Niranjana	10	2	Nesapakkam	Vel	10	5	10	7	2	2	2	2	2	1	26	134	180
479	Jennifer	10	2	MGR Nagar	Vel	12	5	10	7	2	2	2	1	2	2	45	143	180
480	Venkatesh	10	1	Ekkatuthangal	Vel	14	3	999	7	2	2	2	2	2	2	34	138	230
481	Divya	14	2	Virugambakkam	SJS	15	1	13	7	2	2	2	2	2	2	59	156	250
482	Kavyanjali	13	2	Virugambakkam	SJS	12	5	7	7	2	2	2	1	2	1	49	163	250
483	Arindam	12	1	Virugambakkam	SJS	13	5	11	7	2	2	2	2	2	2	33	154	240
484	Sanjeev	10	1	Ashok Nagar	Vel	999	3	999	7	2	2	2	2	2	2	30	141	250
485	Guntur Saravana	10	1	KK Nagar	Vel	999	4	999	7	2	2	2	2	2	1	33	142	300
486	Jyothi Kumari	10	2	Ekkatuthangal	Vel	13	5	13	7	2	2	2	2	2	2	30	135	180
487	Ameena Begum	9	2	KK Nagar	Vel	13	5	13	7	2	2	2	2	2	1	30	136	200
488	Mohan Kumar	13	1	Valasaravakkam	SJS	9	5	10	7	2	1	2	2	1	1	29	150	260
489	Sajini	12	2	Virugambakkam	SJS	999	5	999	7	2	2	1	2	2	1	26	146	260
490	Surendiran	12	1	Virugambakkam	SJS	13	5	11	7	2	2	2	2	2	2	33	154	240
491	Adithan	10	1	Vadapalani	Vel	13	5	999	7	2	2	2	2	2	1	20	142	220
492	Trisha	12	2	Maduravoyal	SJS	9	5	9	7	2	2	2	2	2	2	27	154	260
493	Shyam Sundar	9	1	MGR Nagar	Vel	13	3	10	7	2	2	2	2	2	1	48	137	250
494	Tejaswi	10	2	KK Nagar	Vel	14	5	999	7	2	2	2	2	2	1	38	150	200
495	Melissa Diana	8	2	KK Nagar	Vel	999	999	999	999	2	2	2	2	2	1	22	129	150
496	Pranesh	14	1	AT Nagar	SJS	15	1	999	7	2	2	2	2	2	1	45	171	340
497	Pradhosha	14	2	AT Nagar	SJS	12	5	10	5	2	2	2	2	2	1	58	156	180
498	Ronita	10	2	Virugambakkam	Vel	10	5	12	7	2	2	2	2	2	1	45	135	260
499	Giridharan	11	1	Jafferkhanpet	Vel	5	5	13	7	2	2	1	2	1	1	45	138	250
500	Manobalan	14	1	Virugambakkam	SJS	10	3	8	7	1	2	2	2	2	2	54	149	290
501	Vasanthi	14	2	Virugambakkam	SJS	15	1	13	7	2	2	2	2	2	2	59	156	250
502	Haripriya	13	2	Ramapuram	SJS	13	5	14	7	1	2	2	2	2	2	71	160	150
503	Dhaarini	14	1	AT Nagar	SJS	13	5	12	7	2	2	2	2	2	1	44	162	250
504	Abhishek Chauhan	14	1	Anbu Nagar	SJS	15	5	13	7	2	2	2	2	2	2	44	157	350
505	Shirley John	10	2	Saidapet	Vel	12	5	12	7	2	2	2	2	2	2	24	134	180
506	Prejith	11	1	Jafferkhanpet	Vel	15	1	999	7	2	2	2	2	2	2	27	138	250
507	Logeshwaran	11	1	KK Nagar	Vel	999	3	999	7	1	1	2	2	1	1	41	143	260
508	Tanya Prasad	13	2	Dhanalakshmi Colony	SJS	13	3	999	7	2	2	2	2	2	2	40	157	210
509	Kalaiselvi	10	2	KK Nagar	Vel	999	5	13	7	2	2	2	2	2	2	29	130	150
510	Sindhura	12	2	KK Nagar	SJS	15	1	13	7	2	2	2	2	2	2	59	156	250